PUBLIC HEALTH.

FIFTH REPORT

OF

THE MEDICAL OFFICER OF THE PRIVY COUNCIL,

WITH APPENDIX.

1862.

(Presented pursuant to Act of Parliament.)

Ordered, by The House of Commons, *to be Printed,*
14 *April* 1863.

TO THE LORDS OF HER MAJESTY'S MOST HONOURABLE PRIVY COUNCIL.

MY LORDS,

IN obedience to the Public Health Act, 1858, I beg leave to lay before your Lordships, for presentation to Parliament, my subjoined Report of the proceedings which your Lordships, under that Act, directed to be taken during the year 1862.

I have the honour to be,
My Lords,
Your Lordships' obedient Servant,
JOHN SIMON.

Medical Department of the Council Office,
31 March 1863.

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MEDICAL OFFICER'S REPORT.

Medical Officer's Report.

The principal proceedings taken by the Privy Council during the year 1862, in matters relating to the Public Health, were as follows:—

I. Public vaccination and supply of vaccine lymph.

first, as in previous years, public vaccination was superintended, and the supply of vaccine lymph was maintained;

II. Industrial diseases.

secondly, in continuance of former inquiries with regard to unwholesome occupations and the diseases resulting from them, inquiry for sanitary purposes was made into the decorative and other uses of arsenic, into the manufacture and applications of phosphorus, and into various branches of London dress-making industry;

III. The cotton famine.

thirdly, with reference to the distress which, during the later months of the year, prevailed in the cotton-working districts of England, and to the imminent danger that typhus and other privation-diseases might follow as epidemics on that distress, watch was kept over the sanitary state of the distressed populations, such precautions as seemed wanting were suggested to the local authorities, and scientific study was given to the economics of diet for the poor;

IV. Cattle diseases in relation to the public supply of meat and milk.

fourthly, as of interest to the ordinary national requirement for wholesome animal food, inquiry was made about various destructive and deteriorative diseases of horned cattle, sheep and swine, and consideration was given to the possible means of lessening the present very great prevalence of such diseases.

V. Minor proceedings.

And besides the above, which were the most important proceedings of the year, there were, fifthly, frequent other proceedings—some of them with local inspection, but most of them only in the form of written correspondence with local authorities—in relation to particular outbreaks of infectious disease, and to the local administration of laws concerning the public health.

I. PUBLIC VACCINATION.

1. *Inspections.*

I. Vaccination.

In superintendence of public vaccination, the Lords of the Council, during the year 1862, ordered the inspection of 190 different unions, containing altogether 900 vaccination-districts. These inspections were made in 208 districts by Dr. Seaton, in 464 districts by Dr. Stevens, in 150 districts by Dr. Sanderson, and in 78 districts by Dr. Buchanan.* Each inspector has made detailed reports with regard to all places inspected by him, and has also stated in one summary report the general results of his inspections. The four summary reports are appended. They describe the present state of public vaccination in the counties of Dorset, Oxford, Berks, Buckingham, Cambridge, Derby, Huntingdon, Leicester, Lincoln, Rutland, Nottingham, and Worcester, in the greater part of Wales, and in considerable parts of Kent, Northamptonshire, Warwickshire, and Somersetshire. Added to the similar summaries which have been in my last two reports, they complete, for more than half of England and Wales, an elaborate picture of the working of a system which the Legislature has designed to be the national protection against small-pox. And from the picture thus given, together with much other information which is before their Lordships, the conclusion cannot but be drawn, that the intentions of the Legislature in this respect are but very imperfectly fulfilled,—that the public defences against small-pox are in great part insufficient and delusive. That this most unsatisfactory conclusion will not be countervailed by evidence which may hereafter come from districts hitherto not reported on,—that, on the contrary, such future reports may rather strengthen than weaken the grounds on which the conclusion rests,—will be evident when the fact is considered, that, in a large and very important share of the districts not yet reported on (namely, in the metropolis and in Yorkshire, which are now in course of being inspected) small-pox is at this moment alarmingly epidemic. Referring for illustrative details to the appended reports of the inspectors, I need not here do more than state generally the circumstances of the failure which has occurred.

In the statutes which, during the last 23 years, have been enacted with a view to the extermination of small-pox in this country, the immediate intentions of the Legislature have been as follows:—

first,—that thoroughly good vaccination, provided at the public expense, under proper and well-notified arrangements, should everywhere and gratis be within reach of persons who may choose to avail themselves of it;

second—but of course subject to the above,—that it should be obligatory on parents to have their children vaccinated, health permitting, within three calendar months from birth,—not necessarily by the public vaccinator, but, if not by him, then by some other medical practitioner whom the parent may select (and then must himself pay) for the purpose;

third—as machinery for enforcing this obligation,—that the fulfilment or non-fulfilment of the obligation should be ascertain-

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* While Dr. Buchanan's vaccination inspections were in progress, the outbreak of typhus in Preston, with the generally endangered state of the cotton districts of Lancashire and Cheshire, and Dr. Buchanan's employment (hereafter reported on) in relation to those matters, made it unavoidable that his vaccination inspections should terminate.

able by reference to local registers kept by the respective registrars of births and deaths,—whom also the law requires to notify to parents the obligation which it has imposed on them; that penalties for non-fulfilment of the obligation should be recoverable by summary proceedings from parents who, after notice, are in default; and that especially boards of guardians in their respective unions and parishes should systematically cause such proceedings to be taken.

With regard to the non-accomplishment of these intentions of the Legislature,—it is true that, owing to the utter and universal failure of the intended register of vaccination, the failure of the other parts of the system cannot be quite accurately measured. But, again and again, the inspectors have come upon cases where, quite apart from the register, there was conclusive evidence of extreme local neglect of vaccination. Among the elementary schools which they visited, schools were numerous where the unvaccinated proportion of scholars was from 20 to 30 per cent. of the whole; in more than a few cases it was from 30 to 40 per cent.; in some it was from 40 to 50 per cent.; and in one case (that of Penn in Buckinghamshire) was as high as 55½ per cent. So again among the young inmates of workhouses, though under the very eye of boards of guardians, the inspectors found similar evidence that vaccination was not duly performed;—for among 38 workhouses which Dr. Seaton inspected, there were 8 where the unvaccinated proportion of children ranged from 20 to 38 per cent.;—and among 74 workhouses which Dr. Stevens inspected, there were 20 where the unvaccinated proportion of children was from 20 to 34 per cent. The less exact evidence furnished by the registers of vaccination justifies a conviction that in many cases the local neglect is greater, even very considerably greater, than those discreditable figures would suggest:—for there are whole unions where there is no reason to suppose that any important number of vaccinations is performed by private practitioners, and where yet the number of vaccinations performed by the public vaccinators does not equal a third of the number of births,—unions, even, where the public vaccinators' vaccinations are as few as 19, 18, 17, 12, and 7 per cent. in proportion to each hundred of births;—and there are instances of districts remaining for long periods, even in one instance, as long as three years, without a single public vaccination being performed.

Evidently, then, the fundamental object of the Legislature—the object of ensuring that every infant (its health permitting) shall be vaccinated within the first few months of life, is very imperfectly attained. And the machinery which the Legislature established for the purpose of enforcing the fulfilment of that object is evidently not operative for its purpose. In explanation of which fact, there are three reasons to be stated;—first, that boards of guardians, except when influenced either by panic of small-pox or by formal remonstrances on the subject have very rarely done all that they might do, and in many

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cases have done nothing, to set the machinery in motion;—secondly, that the machinery itself is so imperfect that, even when used with good will, it must be insusceptible of exact working;—and thirdly, that the compulsive provisions of the law (perhaps leniently intended by the Legislature to be ambiguous and feeble, rather than clear and stringent) have in different places been subject to different magisterial interpretations, and have in all places been found insufficient for thoroughly accomplishing their supposed object.

It remains, however, to be observed that imperfect stringency for compulsive purposes is not the only, nor in my opinion the principal, defect of the present law.* The condition which assuredly the Legislature intended to be a condition precedent to any enforceability of vaccination,—the condition "that thoroughly good vaccination provided at the public expense "under proper and well notified arrangements should every"where and gratis be within reach of persons who may choose "to avail themselves of it," is hitherto very imperfectly realized. Both with regard to existing local arrangements for gratuitous vaccination, and with regard to the required notification of such arrangements, the public has at present ample reason to complain that the conditions are not fulfilled under which alone a system of compulsory vaccination can be tolerable. Partly through the continuance of faults to which I adverted in my second annual report, as faults which their Lordships' regulations of December 1859 were intended to correct, but still more (as described in my last annual report) through the general ill-devisedness and futility of those contracts which pretend to regulate the duties of vaccinators, it results,—not only that to a very great extent vaccination is given in a most impunctual and irregular way,† often without proper local notification‡,—but moreover, that

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* It appears, indeed, that the combined efforts of the registrar and public vaccinator, or even extreme diligence of the latter officer alone, may to a great extent, so far as numerical results are concerned, compensate for the insufficient compulsiveness of the law. And if uniformly throughout the country registrars and public vaccinators had adequate inducements to co-operate, or even if public vaccinators had adequate inducements to give extreme diligence to duties not legally incumbent on them, the local vaccinations might not be in defect. But such inducements are absent.

† This result, amply demonstrated by the inspections of former years, was again, in 1862, a matter of constant observation. Of 150 districts in which Dr. Sanderson inquired, there were only 108 where even the existence of contracts was a certainty, and in 70 of these 108 the contracts were entirely disregarded. *See* also Dr. Seaton's report, p. 52;—Dr. Stevens's, p. 73;—Dr. Buchanan's, p. 110.

‡ Dr. Buchanan reports that, among the 15 unions which he inspected, "in two "unions only were the existing arrangements for public vaccination properly "advertised." *See* also Dr. Seaton, p. 54, and Dr. Stevens, p. 75. But the greatest defect in respect of notification is the fact that, under the present system of inoperative contracts, the registrars commonly find themselves without proper means of notifying to parents what are the times and places for public vaccination. For instance, the following is Dr. Sanderson's finding in the 79 registration-districts of the 28 unions which he inspected;—in 32 districts the registrar omitted to notify the times of the public vaccinators' attendances; in 26 districts he notified attendances which the public vaccinators did not give; in 6 districts he correctly notified the attendances given, but they were not the attendances prescribed by the respective vaccinator's

thoroughly good gratuitous vaccination is by no means uniformly* given by those authorities whom the Legislature has made responsible for giving it. And under these circumstances it would manifestly be unjust to punish, for non-compliance with the law, parents whose children are not vaccinated.

I have, therefore, had no alternative but to submit, for their Lordships' consideration, that the laws now in force for the purpose of extirpating small-pox are not likely to accomplish their object, and that the system established by law for the provision of public vaccination works in an unsatisfactory manner.

2. *Supply of Vaccine Lymph.*

Particulars as to the supply and distribution of vaccine lymph during the year 1862, and means for comparing their Lordships' recent proceedings in this respect with the proceedings of previous years, are given in several appended tables. *See* Appendix No. II.

Besides seeing to the merely quantitative supply of lymph, their Lordships, during 1862, took special means to satisfy themselves that the lymph which was being supplied under their auspices was lymph of undiminished efficiency. For this purpose, under their Lordships' orders, I requested Mr. Robert Ceely of Aylesbury to inspect all the sources whence lymph is contributed to the National Vaccine Establishment. Mr. Ceely's inspection did not lead him to recommend any change of the present sources of supply. On the contrary, in those stations which (as being most frequented) gave him the best opportunities of forming conclusions on the subject, he "met with "abundant evidence of the perfectly satisfactory character of the "lymph there in use." In reporting this judgment of Mr. Ceely's, I cannot over-state the importance which I attach to it. For to Mr. Ceely, more than to any man since Jenner, the medical profession of this country is indebted for its knowledge of the natural history of vaccination. And in my opinion there is no living person on whose testimony the public could more entirely rely as to the quality of the lymph which their Lordships are responsible for distributing.

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contract; only in 6 districts did he notify according to fact attendances which were according to contract. *See* also, in this respect, Dr. Seaton's report, p. 54,—Dr. Stevens's, p. 75,—and Dr. Buchanan's, p. 111.

* Very important evidence on this subject is again given in the reports of the present year. Among 127 districts for which Dr. Sanderson reports on the quality of vaccination (as evidenced by the scars observed on the arms of school children examined by him in each district) there were 21 where the proportion of vaccinated children judged by him to have been badly vaccinated ranged from 30 to 62 per cent.;—and there were only 30 districts where, in his judgment, more than half the vaccinated children had got good protection against small-pox. *See* also Dr. Seaton's report, p. 47;—Dr. Stevens's, p. 66;—and Dr. Buchanan's, p. 113. Some important facts as to the relation which the quality of local vaccination bears to the local vaccinator's method of operating are given by Dr. Seaton at p. 48, Dr. Sanderson at pp. 99–106, and Dr. Buchanan at page 115.

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3. *Educational Vaccinating-Stations.*

Mr. Ceely's inspection of the sources of lymph-supply incidentally included an inspection of the Educational Vaccinating-stations of England.

During 1862, no change was made in the number or working of these stations.

II.—INDUSTRIAL DISEASES.

II. Industrial Diseases.

Of the inquiries made during 1862 into occupations which endanger health, two were completed. Reports relating to them are appended,—viz., a report by Dr. Guy on the manufacture and applications of *arsenical green*, and a report by Dr. Bristowe on the manufacture and applications of *phosphorus*.

1. *The occupations which have to do with arsenical green.**

Work-people who have much to do with arsenical green are liable to suffer from its influence in two different ways;—first, almost universally they suffer, and in many cases very grievously, from peculiar skin-affections which the irritating arsenical dust of the occupation engenders;—secondly, in many cases, the arsenic gets absorbed into the body, and produces with more or less severity the ordinary signs of chronic arsenical poisoning. These results do not fall with equal severity on all branches of the industry, nor on all industrial establishments, but, both in different branches of occupation and also in different establishments, proportion themselves to the intensity of the arsenical influence. It accordingly deserves particular notice that the occupations which have to do with arsenical green are pursued entirely without restriction by law. And the evidence now submitted with regard to these occupations corroborates, I think, very importantly the general conclusion which an accumulation of other evidence led me to suggest in my last annual report,—that all industrial establishments which directly or indirectly endanger health ought to be subject to official superintendence and regulation.

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* In connexion with the present inquiry, notice has necessarily been taken of the eventual uses which are made of arsenical green, and of the effect which some of these uses may have upon the public health. Although every one knows that the so-called "emerald green" is an admirable pigment, not every one knows and remembers that "emerald green" is a virulently-poisonous compound of arsenic. And hence it comes that the pigment is extensively employed in ways which are utterly improper in the case of so dangerous an article. Materials coloured by it are seen in many directions where the public, if duly informed, could scarcely consent to tolerate the danger;—not only on a comparatively small scale in the lining of boxes, the painting of children's toys, the wrapping and ornamentation of confectionery—if not even the confectionery itself, but also, and copiously, in the paper-hangings of rooms, and in the wreaths and tarlatanes of ball-dresses. Dr. Guy's report contains illustrations of the mischief which every now and then arises from one or other of these objectionable uses of the pigment.

Sufferings from arsenical green arise much more during the applications, than during the manufacture and packing, of the pigment. Indeed the *manufacture*, if done in the open air, does not seem to produce extreme ill-consequences. The arsenical dust, like all dusts, irritates the mucous membrane of the nose and eyes: presently it begins to affect the skin (especially at the nostrils, at the bend of the arms, at the armpits, and at the scrotum), producing itching, blotches, rawness, and perhaps boils; and these inconveniences, it seems, commonly make the workman discontinue work before he has absorbed such a quantity of arsenic as would affect his internal organs and develop signs of true arsenical poisoning.

The *industrial applications* of the pigment are principally two:—first, in the colouring of various papers, either of the sorts used for ornamental wrapping and lining, or of the sorts used for hanging in rooms;—secondly, in the colouring of artificial leaves, fruits and flowers. The pigment is also used, though less considerably, by chromolithographers and toymakers. It is likewise used by house-painters. It is used as a colour for tarlatanes. And most culpably, though only to a small extent, it is used by the makers of cake-ornaments and coloured confectionery. So far as concerns the health of persons employed, only the first two occupations require particular notice:—but, in them, there is very considerable suffering.

Thus, for instance, in visiting one of the larger establishments where artificial leaves are made—an establishment employing about 100 young women, Dr. Guy found that more or less suffering was almost universal among the work-people. The skin-affection, which hardly any of them escaped, and which sometimes would begin after even so little as one day's working, occurred in different degrees;—sometimes as mere erythema, sometimes as an eruption of clustered papules, vesicles, or pustules, sometimes as more or less destruction of skin by process of ulceration or sloughing. The fingers, which (often with accidental chops and scratches on them) are the immediate agents in the industry; the face; the neck, especially about the roots of the hair; the flexure of the arms; the axilla; the genitals;—these were the parts where the skin-disease had most shown itself,—parts, namely, to which the arsenical dust is most largely applied, and parts where it is likeliest to be retained, and parts where the cuticle is most thin and penetrable. The suffering from these skin-affections had been in many cases very considerable;—for instance, in several cases the mere pudendal affection had been such that the sufferers could not bear to sit down. But the skin-affection was only a minor part of the suffering. Of 25 of the sufferers whom Dr. Guy examined, nearly all showed signs, often highly developed, of chronic arsenical poisoning;—excessive thirst; nausea and loss of appetite; sickness and vomiting, often with pain in the stomach; palpitation and shortness of breath; debility, fever, headache, drowsiness, dimness of sight, and

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1. Working with Arsenic.

tremblings, nervous twitchings or convulsions:—" Of the whole " group of 25 females (says Dr. Guy) four only did not complain " of weakness; and of the remaining 21, there were again only " four who did not describe the weakness as extreme. Febrile " symptoms were present in no less than 20 cases, in five of which " they amounted to feverishness, while in the remainder they " were described as fever. Headache, again, was an almost " universal symptom. It was absent in two cases only, and " was described as not severe in only three cases. Dimness of " sight was complained of in two-thirds of the cases. In one the " eyes were very sore, in another the sight was greatly impaired. " Drowsiness was present as a marked symptom in every instance but one, and in two cases only was it spoken of as a " trivial circumstance. Tremblings and convulsive twitchings " were present in seven cases out of the 25, and in one other " instance well-marked convulsions were present." It is wonderful that, out of such a group as this, deaths are not constantly occurring in a way to demand the coroner's investigation. But whatever may be the explanation of the fact, only one such investigation seems to have been made. The death which gave rise to it (and which occurred towards the end of the year 1861) was certified by the coroner's jury to be " Death by " Arsenite of Copper." The victim—a girl of 19, whose case is told by Dr. Guy, had for 18 months without intermission, in spite of cruel sufferings, pursued her poisonous occupation. Her story during nearly all this time was but the common story of the workshop,—only the same sort of story as Dr. Guy elicited from many of those whom he examined. During the whole time she had " suffered from eruptions about the neck, scalp, and hands, " accompanied by pains in the nose, with the common symptoms " of a cold, great pain in the left side, frequent vomiting of food, " and intense thirst. She was first seen by Mr. Paul [the medical " man who attended her] on the 15th of November. She was in " bed, breathing laboriously, and complaining chiefly of the pain " in the side and frightful thirst. The countenance wore an " expression of great anxiety, and the conjunctiva had a peculiar " green tint. The pulse was about 120, and very small. The " tongue was dry, brown down the centre, and green on each " side. The vomited matter was quite green, but the discharges " from the bowels had a natural colour. There was little diarrhœa. " The skin was very hot. The abdominal parietes were drawn " back, but the abdomen was not painful, except just over the " stomach. There was a slight cough, but no expectoration. On " the following day she still complained of pain and thirst, and " her pulse was 130. At the evening visit the breathing had " become much more laborious, and the pupils were dilated. On " the 17th the pulse was of the same character, but increased in " frequency. The vomiting continued till the evening, when she " still complained of the pain, which was worse. On the 18th she " was found in the same state, but on the 19th she was seen to be

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"sinking fast. She had twitchings of the left side of the mouth, "and was scarcely able to speak, but she said that everything she "looked at was green. The pulse had risen to 140. During the "night of November 20 she became insensible, and died at 11 a.m."

The tortures which that poor girl must have endured will not have been in vain, if, as may be hoped, the public knowledge of them leads to the amendment of a system under which others are still day by day enduring in different proportions the progress of a similar fate.

The restrictions under which this injurious, and perhaps not indispensable, branch of industry ought alone to be carried on are, in my opinion, as follows:—first—as a cardinal rule (the enforcement of which would make it an interest of each establishment to enforce various improvements of detail) the employment of any person while presenting even in the slightest degree any sign of general arsenical poisoning should be absolutely prohibited;*—secondly, by scrupulous cleanliness of the workplace and workers, by ventilation of the workplace, and where necessary by special apparatus, the best known means should be used to prevent the diffusion of arsenical dust in the common atmosphere of the workplace, and to reduce the worker's liability to receive the dust upon his hands.†

2. *The occupations which have to do with phosphorus.*

The utilisation of phosphorus in various popular contrivances for producing instantaneous light has, for the last 30 years, been a special industry. And with the growth of this industry, a new disease has come into existence. About 18 years ago observations began to be published to the effect that, of the workpeople who in the new industry were exposed to the vapours of phosphorus, some, but apparently not a large proportion, suffered in consequence of the exposure a peculiar disease of the jaw-bones; namely,—that, after a variable premonitory period of such moderate local irritation as might be supposed to be mere common toothache or gumboil, evidences of destructive bone-disease—affecting commonly at first only a small portion of bone, but perhaps

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* The observations, which in my last annual report (p. 27, foot note) I made on the injurious effects of extreme subdivision of labour are applicable to the present subject. Working with an arsenical pigment might not cause any appreciable injury to health, if it formed only a small part of the worker's total occupation. A manufacturer, properly organizing his business, ought of course to secure this result; and the rule which I have suggested in the text would perhaps be the readiest mode of bespeaking his exertions to secure it.

† The dangers to which the general public is exposed by the various ulterior uses of emerald green (see former foot note at page 10) cannot, for the most part, be adequately guarded against except by better public knowledge on the subject. It would be desirable, however, that the use of emerald green by confectioners, either for confectionery itself, or for any wrapping or ornament of confectionery, should be punishable by summary proceeding. And it would also be desirable that the sale of emerald green and of objects coloured with it should be subject either (*mutatis mutandis*) to the same rules as govern the sale of white arsenic, or, at least, to such rules as would ensure the purchaser's being fully informed that the commodity which he purchases is poisonous.

eventually invading all or nearly all of the lower or of the upper jaw, would become manifest,—that in average cases of this very painful and very loathsome disease, recovery was not got except after sufferings which could scarcely be of less than many months', and often were of some years', duration,—that in severe cases the patient was likely to sink under the pain and exhaustive discharges of the disease, and that at best he would be left deformed and mutilated. Almost as soon as the disease was recognised, investigations were made into the details of its pathology. And these investigations established as certain, that the disease is in its origin purely local,—that it depends on an influence which the fumes of phosphoric acid, when they get dissolved in the saliva, are able to exert directly and specially within the mouth.*

From the inquiry which has now been made under their Lordships' direction into the circumstances of the phosphorus-industry in England, it appears (as had been anticipated) that the jaw-disease which I have described is not of frequent occurrence. Dr. Bristowe, after visiting all the known match-making establishments in England—57 establishments, employing about 2,500 hands, has not been authentically informed of more than 59 cases (past or present) of jaw-disease. And though doubtless in some instances information has been withheld from him by manufacturers who feel that their experience has not been creditable to them,—so that the total production of jaw-disease during the last 30 years has been greater, perhaps considerably greater, than these numbers express,—yet very probably there would be no under-statement of the truth in applying these numbers to the *present time*, and in assuming that now (with the improved arrangements which a less favourable early experience has induced all respectable manufacturers to adopt) not more than two or three cases of the jaw-disease are annually produced in England. Almost certainly, however, these few cases occur under circumstances which the manufacturer ought not to let exist, and which —if dangerous occupations were subject to official superintendence, would of course be forbidden to continue. For, as Dr. Bristowe observes, " while it is the easiest thing in the world " for a factory to be made a hot-bed of disease, it is little less " easy, by adopting precautions of the simplest and most obvious " description, to render the occurrence of jaw-disease therein a " rare and quite exceptional occurrence."

Those precautions of the " simplest and most obvious descrip- " tion," to which Dr. Bristowe refers as essential for the phos-

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* Von Bibra, the most important among the original writers on the disease, believed, both from inquiries which he made of work-people, and from experiments which he performed on rabbits, that the phosphorus-fumes could not act hurtfully on the jaw if the teeth and gums were in a normal state; and from his teaching it has been commonly believed that a carious state of teeth (as allowing the acrid influence of the phosphorus-fumes to soak more easily to the deeper textures of the jaw) is the great predisposing circumstance against which precautions ought to be taken. From statements made in Dr. Bristowe's report, it seems that Von Bibra's conclusion ought not, without further inquiry, to be taken as absolutely established, and Dr. Bristowe has therefore been instructed to seek for proofs which may be conclusive on the subject.

phorus-worker's safety, and respecting which he gives in his report all needful particulars, are, in principle, two:—first, that the organization of the establishment shall be such as not at any time to expose to phosphorus-fumes more workers than must necessarily be exposed to them,[*] and such as to restrict this necessary exposure within the narrowest possible limits of time and intensity; secondly, that the establishment shall have suitable ventilation—including of course special ventilating-arrangements for those processes of the manufacture which cause the greatest evolution of fumes. That precautions to the above effect are entirely effective for their purpose, is shown by many passages in Mr. Bristowe's report,—passages which contrast the experience of well-conducted establishments with the experience of ill-conducted establishments, and justify me in referring exclusively to ill-conducted establishments the production of all jaw-disease which there has been. One such passage, which contrasts the experiences of a single establishment at two different times of its working, is so suggestive that I quote it here in Dr. Bristowe's words:—" By far the most remarkable " and instructive experience of the disease, however, is that " afforded by a congreve-manufactory in Manchester, which is " one of the largest in England, and in which 250 persons, ex- " clusive of box-makers and splint-cutters, are constantly em- " ployed in the various processes of match-making. This factory " has been in existence for about 25 years, and during the first " 20 years of its operations, no less than 24 cases of jaw-disease " occurred. The jaw-disease too, in this case, was not limited, " as in most other factories, to the dippers and mixers, and con- " sequently to adults; but the boxers, the cross-cutters, and the " pickers out, formed a large proportion of those affected; and " children from 12 to 15 years of age suffered as well as their " elders. The explanation, however, is easy, and was pointed out " to me with great candour by one of the proprietors. The fact " is, that all those various conditions, which tend to the produc- " tion of the disease, were here concentrated and combined; " and all the operatives became nearly equally exposed to the " fumes of phosphorus. A very large number of workpeople " was employed. They were confined in low, ill-ventilated, over- " crowded rooms. The dipping, the drying, the boxing, &c. were " all carried on in the same apartment. Bundle-dips formed a " large proportion of the matches which were manufactured; and " the composition employed contained one-third by weight of " phosphorus. Further, at one period (and about that time the " disease was most prevalent) the operatives worked far into the " night, as well as by day. About five years ago, the proprietors, " who had been much concerned by the frequent occurrence of " the disease, set to work seriously to remedy the defects on " which they believed it to depend. They constructed large,

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[*] Whether these must always be the same persons is a question which I think deserves consideration. *See* preceding foot note, p. 13.

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" airy, well-ventilated rooms, they gave up the manufacture of " bundle-dips, and they diminished by one-half the strength of " their composition. The result has been, that not a single case " of the disease has originated in this factory, during the five " years that have elapsed, since the above improvements were " effected."

The dangers to which I have adverted as belonging to the phosphorus-industry belong exclusively to working with *common* phosphorus. Working with *amorphous* phosphorus is unattended with danger to health. Since, however, it appears that, with reasonable precautions, the use of common phosphorus for match-making needs not be an unwholesome occupation, I cannot say that, in my opinion, the substitution of amorphous for common phosphorus in the manufacture is, for sanitary purposes, an object to be unconditionally insisted on. Yet having regard to the fact, that amorphous phosphorus not only is manufactured without danger to the worker, but that its use in lucifer-boxes (according to the patented plan of Messrs. Bryant and May) also involves infinitely less danger of fire than belongs to common lucifer-boxes,—I think that the substitution is altogether one to be desired. And of course, with reference to any restriction which the Legislature might think of imposing on the utilisation of common phosphorus, it would deserve to be remembered that manufacturers would have at their option the alternative of using without restriction the innocuous amorphous material. As regards the admissibility of this material, I beg to refer to the statements thereupon which Dr. Bristowe quotes from three principal firms of match-makers.

Before closing the present section of my report, I must specially mention that, in both the industries reported on, young people, from childhood upward, are employed in uncertain proportion. If the occupations are to be so regulated as no longer to include special causes of unhealthiness, the question whether young persons shall work in them will only be part of the more general question (on which I need not now dwell) whether the employment of young persons, as such, should be the subject of particular restrictions. But if the occupations—and especially the first mentioned of them, are to continue unregulated, it will certainly deserve particular consideration that, among the persons exposed to injury, are persons whom the law of this country supposes incapable of properly defending their own interests.

III. THE COTTON FAMINE.

III. The Cotton Famine.

In the month of October last there was room for very great anxiety as to the sanitary prospects of the cotton-districts of England.

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The staple industry of those densely-peopled districts—the industry which previously gave livelihood, direct or indirect, to two millions of population, had for some months been declining, and was now probably at not more than a sixth part of its usual activity. Wide-spread bitter poverty was of course the result.

And this poverty was in strong contrast with former circumstances. The affected class was not a common low-typed proletariat, familiar with parish doles, and preferring pauperism to labour. On the contrary, it was a people long accustomed to prosper on the fruits of its own labour, a people having among it a good deal of mental culture and some great moral qualities, a people legitimately proud of its old self-supporting power and independence. Borne down of late by the increasing stress of a poverty which was quickly tending to become absolute privation, the sufferers had not clamored as to their growing need for help. Even to the last they had rather shrunk from disclosing it. Swarms of them had long been hungering in silence. As wages had begun to fail, first, in many cases, there were previous well-earned savings to be exhausted; then, in nearly all cases, there was household furniture and bedding, or at least clothing, which might be pawned or sold. Gradually during the summer these resources had been drawn upon; but doubtless very reluctantly, not at the first partial failure of wages, not till hunger became urgent, not a bit more than hunger must have its way.

And now, in October, a crisis in this long contest was at hand. Besides the pauperism which was known, there was an unascertainable, but enormous, amount of impending destitution. The ill-nourished were in myriads. Machinery, local or national, for giving relief to the distressed populations, such machinery as afterwards became most effcient, was hitherto but imperfectly organized. There was imminent danger that death on a large scale might result directly or indirectly from starvation.

Foremost there was the unwonted possibility that England might have to endure, almost without power of arresting if begun, the terrible spectacle of a famine fever. For the circumstances under which true TYPHUS (the "gaol-fever" the "camp-fever," the "ship-fever," of our ancestors) can do its worst as a national epidemic, are provided for it by extreme poverty and destitution. The disease is never otherwise than contagious, and its contagion spreads like wild-fire among any half-famished population. Sixteen years ago, Ireland had had this most dreadful of sanitary experiences. And now, in October, there were rumours and, as afterwards appeared, well-founded rumours, that typhus had begun in our cotton-districts. There was the knowledge, too, that wherever typhus might show itself in those districts, hunger would not be the only baneful influence in favour of its spread. Eminently contagious as it is by means of exhalations from the sick, and only partly divestable of that property by even the best ventilation of the best hospitals in Europe, it must

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of absolute necessity spread wherever persons who have not previously suffered its attack encounter its intense contagium in over-crowded ill-ventilated dwellings. And this danger had to be apprehended in the cotton-districts. For means of rent-paying had ceased. Partly in consequence of eviction from former lodgings, partly in voluntary search for the cheapest obtainable shelter, the population had been gradually getting more and more restricted in dwelling-space. As colder weather began, as the want of fire began to be felt, as the absent clothing and bedding began to be missed, so, more and more, for warmth's sake, the dwelling-spaces were sure to be without ventilation and the inmates to be huddled together. Within the atmosphere of any such dwelling-places, the spark of typhus-contagion, if it should enter, would find every opportunity to spread.

Under these circumstances, my Lords had to watch carefully all fluctuations of health in the distressed districts, and to satisfy themselves that due local precautions were being taken to prevent the destitution which breeds disease. With this view their Lordships determined to have for the rest of the year a medical Inspector constantly in the suffering districts, from whom every day they might receive information, or through whom give advice, concerning these very important matters; and the gentleman, whose services I under their Lordships' directions engaged for the purpose, was Dr. Buchanan, one of the physicians to the London Fever Hospital.

As I append the summary report which Dr. Buchanan made when his inspection was drawing to an end, I have only to describe in general terms the duty which he performed. His attention was of course primarily directed to those towns where true typhus prevailed or was rumoured to prevail. His first and longest visit was therefore paid to Preston, and afterwards inquiry was made into the alleged existence of fever in Ashton, Blackburn, Chorley, Darwen, Manchester and Salford, Stockport and Wigan. More recently Accrington, Bacup and Bolton were visited with the same object. At Ashton, Stockport and Wigan, no remarkable excess of fever was found; at Darwen, Bacup, and Bolton fever was found with unusual prevalence, but the fever was typhoid, not typhus; at Blackburn, Chorley, and Salford there appeared to have been scattered cases of true typhus; at Accrington* and Manchester such cases were in larger number; and in Preston the epidemic was considerable.†

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* Accrington was not visited till January. It then appeared that 40 cases of true typhus had occurred since the middle of October. Among these there had been 9 deaths.

† In all those towns where most typhus fever was seen, the disease attained its maximum of prevalence before December, and in that month there appeared a decline in its epidemic force. At Accrington and Manchester at the beginning of January the fever had so far ceased that for a fortnight scarcely a single new case had come under treatment in either town. In Manchester the monthly variations in the amount of typhus are best measured by the experience of the parochial fever hospital, where alone typhus patients are received in any number. Since Midsummer the admissions

In all the towns enumerated, as also in Bury and Oldham, inquiry was made into the general sanitary circumstances of the poor, and especially of the unemployed cotton operatives. So far as was needful for their Lordships' purpose, Dr. Buchanan communicated with the different local authorities and their officers, and conveyed their Lordships' suggestions as to the means that appeared most desirable for preventing the outbreak or checking the progress of disease. Especially he drew attention to cases where the allowances made to the unemployed population were not enough to maintain health, to cases where clothing and bedding were deficient, and to cases where overcrowding and uncleanliness were tending to multiply infectious disease. In these and like cases he discussed in detail with local authorities and their officers the remedial means which in the particular town were most applicable. Also, in order to guard against contagious fever spreading in those towns where it had appeared, he conveyed their Lordships' strongest recommendations that the sick should be removed, from their commonly overcrowded and unwholesome homes, to hospitals. And where the hospital-accommodation of a town threatened to become inadequate, means for meeting any increased demand which might arise were suggested.*

While getting intelligence with regard to the progress of the cotton famine, and of the measure taken for its relief, their Lordships found it expedient also to provide themselves with more exact scientific information than was at the moment available with regard to the minute economics of diet. What was the least outlay of money which would procure food enough for healthy life?—and what plan of outlay would purchase the largest amount of true nourishment?—these questions were constantly under discussion. Questioners were naturally solicitous for an almost fractional accuracy of answer, and special scientific investigation was needed to supply the material for answering. Accordingly, under their Lordships' orders, I requested Dr. Edward Smith to make all requisite inquiry for this purpose. And the result is a report (Appendix No. V.) which discusses very minutely the whole subject of dietaries for the poor.

It was a most satisfactory issue to the anxieties of 1862 that typhus did not become extensively prevalent in the cotton-dis-

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for this disease had been as follows:—In July, 7; in August, 8; in September, 12; in October, 20; in November, 25; in December, 17; and in January, 16, all in the latter part of the month. Besides these there were cases treated at the infirmary and at their own houses. At Preston the attacks of typhus (as reported by the public medical practitioners to the Local Board of Health) were as follows from month to month. In July, the new cases numbered 2; in August, 8; in September, 33; in October, 95; in November, 95; in December, only 42, and in January, 41.

* Preston was the only town in which, at the time of Dr. Buchanan's visit, further provision for fever patients was urgently required, and here the immediate construction of temporary fever wards was advised. Accordingly a wooden building adapted for 60 patients, on a plan agreed on by the Borough Surveyor and Dr. Buchanan, was erected in November.

tricts, and that, so far as the facts are yet known, there was no other great local derangement of the public health.

Because the Registrar-General's detailed information as to district-mortality is not available till about 18 months after the expiration of the year to which it relates, I cannot speak with confidence as to the exact influence which the cotton-famine has exerted on the death-rates of the affected populations. But, meanwhile, I would venture to suggest that caution is necessary in interpreting one broad fact which the Registrar-General has made public. It is certain that in some of the cotton-districts, during the winter months, the total mortality was less than usual; but it does not therefore follow (as some commentators on the fact have apparently believed) that the health of the distressed operatives was substantially better than usual,—that the privations which their enforced idleness entailed on them were less hurtful than their factory-occupation of common times. No doubt, indeed, but that factory-occupation produces, on a very large scale, chronic ill-effects on health; but, till further evidence be given, it must not, I think, be assumed that an interruption of factory employment can rapidly make such a diminution in the death-rate of the operatives as shall outweigh the evidence of injury from considerable degrees of privation. Assuredly, such a conclusion cannot be based on any facts which have yet been published with regard to the matter in question. A smaller than ordinary number of deaths in particular cotton-districts during the past winter may have been only one of those common predictable fluctuations of mortality which go to furnish average local death-rates, and may, indeed, have been a higher mortality than the districts without the cotton-famine would have had. But where this was not the case, where the cotton famine truly lessened the local mortality, the saving may not have been of adult life. It may have been exclusively of infants. For the closure of the factories withdrew perhaps the deadliest influence with which the infantine population of the cotton-districts has to contend,—the influence which (as was shown in my last report) is exerted against infant life by the industrial occupation and absence of mothers. And, having regard to the great importance of this change, I can well conceive that in some places the total number of deaths may have been notably smaller than usual even though the adult mortality have been considerably heightened by the cotton-famine.

These considerations are not advanced as of mere speculative interest. In the uncertainty which at present must be felt as to the industrial prospects of the cotton-workers, and with reference to the possibility that another winter may have to be faced under circumstances like those of the last, it is, in my opinion, of great practical importance that the sanitary dangers of privation should not be at all underrated.

Obviously, as regards the past, it is matter of fact that evils which might well have been anticipated did not fall, or at least

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did not heavily fall, upon the distressed populations. And for this happy result thankfulness is due, partly to the noble and successful exertions which were made, both locally and nationally, to avert extreme destitution from the endangered masses of population, and partly to the almost singular mildness of the winter.

But so far as that winter's experience of the cotton-famine is to be deemed prospectively applicable, it will be essential to remember that of the two influences by which the famine was alleviated, only one was of human option,—that the other might, notwithstanding all hopes and wishes, have been absent,—that, if the temperature of last November had continued through Decem- and January—still more, if the temperature of these two months had (as usual) been much below the temperature of the November, the sufferings of the population must have been far severer than they were, and typhus could not but have spread much more extensively than it did.

IV. DISEASES OF LIVE-STOCK IN THEIR RELATION TO THE PUBLIC SUPPLIES OF MEAT AND MILK.

IV. Cattle diseases in relation to supply of Meat and Milk.

Allegations have during the last few years been abundantly made, and have with the progress of time become more and more definite, that the flesh of animals slaughtered while in a state of disease, and likewise the milk of diseased animals, are extensively sold for human consumption in the United Kingdom. And the substance of these allegations has been submitted to the Lords of the Council. In 1862 their Lordships ordered an inquiry to be made in this matter, and under their directions I requested Mr. John Gamgee, Principal and Professor in the Edinburgh New Veterinary College, to report on it. For their Lordships' purpose it was likewise desirable that inquiry should be made as to the circumstances under which the more important diseases of stock prevail in the United Kingdom, and particularly into the influence of importation and of home-trade in spreading the infection of such diseases. So Mr. Gamgee was instructed to report also on this matter. And he was further instructed to quote in his report any statements credibly made to him as to injurious effects resulting to man from the consumption of the flesh or milk of diseased animals. In order to collect all requisite information for his report, Mr. Gamgee was authorized to visit any principal markets and slaughter places in the United Kingdom, as well as any districts where he might believe that disease was particularly rife; and he was further authorized to visit certain parts of the Continent with which our stock-trade is most active, and whence it seemed most possible we might be receiving infectious importations of stock.

Under the above instructions Mr. Gamgee has recently made a report, which I append. *See* Appendix No. IV. His evidence is, in substance, as follows;—that disease prevails very extensively in the United Kingdom among horned cattle, sheep and swine;

that the diseased state of an animal not only does not commonly lead the owner to withhold it from being slaughtered for consumption as human food, but on the contrary in large classes of cases (especially where the disease is of an acute kind) leads him to take immediate measures with a view to this application of the diseased animal; and that consequently a very large proportion (Mr. Gamgee believes as much as a fifth part) of the common meat of the country—beef, veal, mutton, lamb, and pork, comes from animals which are considerably diseased.

The diseases which figure behind the scenes of our dead meat market are of course various. And although for the purposes of this report it is not necessary to enter upon much detail concerning them, yet, in order to discuss their probable effect on the quality of meat, the more important kinds of disease must be separately spoken of. And they are three;—viz.: first, *contagious fevers;*—secondly, the so-called *anthracic and anthracoid diseases;*—thirdly, *parasitic diseases.*

Of the *contagious fevers* of stock, two are now widely prevalent in the United Kingdom,—namely, the *pleuro-pneumonia or lung-fever* which is peculiar to horned cattle, and the *aphthous fever, or foot-and-mouth disease,* which affects indifferently and in common horned cattle, sheep, and swine. A third disease of the same class—the *small-pox* of sheep, perhaps of all murrains the most dreaded in this country, is not known to be now prevailing among our flocks; but, a few months ago, an outbreak of it in Wiltshire excited the greatest alarm; and it is a disease which may at any moment be spreading here. A fourth most important contagious fever of stock—the very fatal *typhoid fever or steppe-murrain* of Russian horned cattle, has happily been kept away from us for more than a century, partly by the exertions which are made in Russia to limit the disease to those provinces where it is endemic, partly by the strict precautions which are taken at the eastern frontiers of Prussia and Austria to prevent contagious importations;—and while this system continues in operation, the steppe-murrain is of little practical interest to us.

Of the so-called *anthracic and anthracoid* diseases of stock—diseases which German pathologists have generalised under the name of *milzbrand,* many prevail to a great extent in the United Kingdom, though for the most part as endemic diseases, localised in particular sections of the country. It is said to be an essential character of these diseases, that the blood of the diseased animal undergoes peculiar—in some respects putrefactive—changes; but commonly the disease involves an occurrence of local infiltrations and effusions of putrescent blood-ingredients or blood; and in many cases there also occur, either primarily or secondarily, gangrenous changes (erysipelatous or carbuncular) in some superficial solid texture of the body Diseases of this class are further characterised by the fact that during their course the diseased body develops in itself a specific morbid poison which by inoculation can be made to spread the disease to other animals, including man. The diseases which Professor Gamgee counts under the present head are as follows:—the *splenic apoplexy* of horned cattle and sheep, the *braxy* of sheep, the *black quarter* of horned cattle and sheep, the *glossanthrax or tongue-carbuncle* of (almost exclusively) horned cattle, the *forms of anthrax which affect the mouth, pharynx, and neck* in swine, the *apoplexy* of swine, and their so-called *blue-sickness or hog-cholera*, the *parturition-fever* of cows, the corresponding *heaving-pains* of ewes, the *navel-ill* of lambs, and the *red-water* of sheep.

Thirdly, there are the *parasitic* diseases of stock,—diseases which consist in the colonisation of the living animal's body by lower animal forms, larval or mature, subsisting at its expense. Such are the following diseases;—the so-called "measles," of the pig, in which disease the *cysticercus cellulosæ* (larva of the *solium* tapeworm) is found more or less abundantly diffused through the muscular system, and perhaps in other parts, of the animal;—the analogous disease of horned cattle, due to the larva of the *t. mediocanellata*;—the various, chiefly visceral, diseases of stock which depend on larvæ of the *tænia marginata* and *t. echinococcus*; —the brain-disease, "gid" or "sturdy," which is due to a larva, mostly of the *t. cœnurus*;—the rot of sheep, due to swarms of adult and oviparous fluke-worms (*distoma*) in the liver;—the lung-disease which, especially in calves and lambs, is produced by different kinds of *strongylus*;—the easily-overlooked, but highly important disease of swine, which consists in an infestation of their muscular system by the minute immature forms of the *trichina*.

It is for obvious reasons impossible, in the present state of knowledge, to state in detail what income of morbid product flows from each of the above-mentioned sources into the markets which supply us with food. But from Mr. Gamgee's report, together with such other information as he has given me, I gather that, so far as he can learn, the truth is about as follows:—that horned cattle affected with pleuro-pneumonia are, much oftener than not, slaughtered on account of the disease, and when slaughtered, are commonly (except their lungs) eaten; and this, even though the lung-disease have made such progress as notably to taint the carcase;—that animals affected with foot-and-mouth disease are not often slaughtered on account of it, but if slaughtered, are uniformly eaten;—that animals affected with anthracic and anthracoid diseases, especially swine and horned cattle thus affected, are (except their gangrenous parts) very extensively eaten;—that the presence of parasites in the flesh of an animal never influences the owner against selling it for food; —that carcases, too obviously ill-conditioned for exposure in the butcher's shop, are abundantly sent to the sausage-makers, or sometimes pickled and dried;—that specially diseased organs will often, perhaps commonly, be thrown aside; but that some sausage-makers will utilize even the most diseased organs which can be furnished them;—that the principal alternative, on a large scale, to the above-described human consumption of diseased

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carcases is, that, in connexion with some slaughtering establishments, swine (destined themselves presently to become human food) are habitually fed on the offal and scavenage of the shambles, and devour—often raw and with other abominable filth, such diseased organs as are below the sausage-maker's standard of usefulness.*

This, in general terms, is Mr. Gamgee's report on the subject. Disgusting as are the reflections which it suggests, there is not in it, I think, anything intrinsically improbable. For obviously wherever there is dangerous disease among stock, the owner's commercial instinct will be to make whatever salvage he can; and while he must well know that selling dead stock for meat pays better than selling it for manure, the public has no sufficient safeguard against his yielding unreservedly to that motive. And if, while his stock is suffering with even the most loathsome of diseases, he thinks fit to have each animal as it sickens, or even as it gets moribund, slaughtered and dressed for the market, assuredly there will often not be any effectual obstacle to his carrying that wish into effect.

One doubt, however, may well be raised on the subject. A first popular impression would be, that, if things are as described, pestilences must be bearing witness to the fact. Is it possible—may be asked—that cattle, having all the foulness of fever in their blood, or having local sores and infiltrations that yield one of the deadliest of inoculable morbid poisons, or having their flesh thronged with larval parasites,—is it possible that such cattle can be converted into human food, and yet not only the immediate scandal of a general poisoning be escaped, but even something not unlike general impunity be the result? Though the affirmative answer to this question may at first sight seem strange, nevertheless it is, with some qualifications, the true one. And doubtless the impunity, such as it is,—but it perhaps is far less general than it appears,—results from the operation of well-known chemical and physiological laws. Our animal food before we take it has for the most part been exposed to so high a temperature that any parasites which had their home in it are killed, and that whatever albuminous morbid contagium it contained has been coagulated and made inert. Probably too, against small quantities of animal poisons—and against such as communicate small-pox and glanders, just as against the venom of the cobra and rattlesnake, the stomach has resources of its own;—for any such organic product entering the stomach is at once (as regards that mobile chemical constitution on which its efficiency depends) exposed to the strong disinfectant chemistry of digestion, and thus, within narrow limits of quantity, is likely to be rendered inert before it can soak into living texture. Both these in-

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* Mr. Gamgee's description of the state to which the swine are brought by this diet raises the question whether for the purposes of this report, they might not themselves properly be classed with diseased animals. *See* below, p. 250.

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fluences may count for something, and the first-mentioned of them for almost everything, in explaining the fact (so far as it is a fact) that many sorts of diseased meat are eaten with impunity. On the other hand it must be remembered, that, in this theoretical explanation, the two protective influences do not cover the whole field of danger ;—for, in the first place, not all meat which is eaten has been exposed throughout (nor in every instance even at all exposed) to a temperature sufficient to kill parasites, and coagulate albumen; in the second place, even complete coagulation of albumen may, for aught which we know to the contrary, leave some morbid poisons in operation ; in the third place it may very well be, that, even where cooking can divest a meat of some original specific infectiveness, the meat may still not be susceptible of quite the same digestional changes as healthy meat, when eaten, undergoes. And thus the theoretical apprehension would be, that, with our alleged large consumption of variously-diseased meat, the impunity of consumers, though it were the rule, might be subject to considerable exceptions.

Accurate empirical knowledge in this matter is hitherto only beginning to be gathered, and will not yet warrant any general dogmatic statements as to the effects of diseased meat on human consumers. But for another purpose, as I shall proceed to illustrate, even that scanty knowledge is not insufficient. Supporting, so far as it goes, the theoretical arguments which I have just used as to the possible dangers of the practice in question, it will at least suffice to justify much public caution on the subject. And in this point of view it may be convenient to notice, under separate heads, the evidence which now exists as to the injuriousness of each chief kind of diseased meat.

(*a.*) First, as regards meat which is *infested with parasites,*—we know with absolute certainty that this may become a source of human disease. Every tapeworm found existing in human bowels was once a cysticercus, or other hydatid, nested either in the living muscle or in some other living texture of an animal which is used for food. Tapeworm unfortunately is not a very rare human affection ; though how it comes to pass that we, not very rarely, get to swallow alive those cystic brute-parasites which are larvæ of the intestinal tapeworm, is somewhat difficult to explain. A mouthful of fresh "measly" pork, eaten raw, would of course explain such an occurrence. But the cysticercus cannot outlive being cooked ; and as the form of cured ham, bacon and sausage is the only form in which uncooked pork is even scantily an article of diet among us, it seems probable that cysticerci may outlive some or all of the processes by which meat is commonly cured, and may thus get swallowed alive by persons who eat uncooked sausage, ham, or bacon.

This however is not our only concern with the tænial order of brute-parasites. Dogs and other animals which get opportunities of eating the raw offal of slaughter-houses are constantly swallowing live larvæ which afterwards become mature tapeworms within them. The mature tapeworm, holding fast by its head to the mucous membrane of its host's intestine, sheds from its other end the successive egg-bearing joints which it developes there ; and wherever the tapeworm-lodging animal passes, these fertile fragments get dropped in all directions with excrement, and lead of course to a wide and dangerous dispersion of eggs. Often the eggs must find their way into sources of drinking-water, or on to various low-growing vegetables or fruits which are apt to be consumed in an uncooked state by man ; and if, with any such vehicle, man swallows a live tapeworm-egg, he immediately has the egg hatched within him, and now in his turn suffers from the larval form of the parasite. Fresh from its egg, the young sexless animal, which he has swallowed, burrows through the wall of his stomach or intestine, and, having thence migrated to some more or less distant part of his body, grows there, destructively, to its full larval development as a cystic entozoon ;—perhaps to show itself one of the sporadic locally sterile cysticerci which are commonest in man's muscle, cellular membrane, eye and brain ; or perhaps (and this oftenest in man's liver) to prove itself the pill-box hydatid or echinococcus, and to illustrate one of the most striking stories of so-called "alternate generation," by breeding almost unlimitedly from its own larval substance, as by buds, new cysts which repeat the form and inherit the fertility of their strange sexless parent.*

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* It is in Iceland that the saddest experience exists as to the above-described "alternate generations" of the tapeworm. There the diseases which are due to the various stages of various kinds of tapeworm prevail to an enormous extent among both men and cattle. Dr. Arthur Leared (who has recently investigated this subject in Iceland, and has kindly permitted me to read the English manuscript of an essay which he has published in Icelandic on the result of his inquiry) says, on the authority of Dr. Hjaltelin, of Reykjavik, that a fifth part of the human mortality in Iceland is caused by hydatid disease. And how great is the influence which the dog exerts as an intermediary in propagating such disease cannot be better illustrated than by the fact of Dr. Leared's having suggested, as one of his two measures for preventing the human hydatid disease, that all the dogs of the island should be medically treated for tapeworm. "The evidence against the dog in this matter" (says Dr. Leared) "rests upon numerous experiments conducted under circumstances leaving " no doubt that tapeworms were produced by feeding them on fresh [hydatid] " bladders. The conditions necessary for the propagation of the worm are no- " where so complete as in Iceland. The farmers kill their own meat, and the offal, " frequently containing living [hydatid] bladders, is the food of the dogs. Abund- " ance of mature worms are thus produced. Again, the whole country is one vast " pasture, and dogs are universally employed in managing the sheep. These dogs shed " everywhere segments of tapeworms, the eggs from which are diffused by rain " and melted snow. . . . . Each segment is filled with innumerable eggs, " invisible to the unassisted eye, which are not set free in the intestine of the dog, " but in the outer world, by the decay of the case containing them. It is impossible " to say to what extent these eggs preserve their vitality, but so resistent is the outer " shell, that I have found them, by examination with the microscope, quite intact " after having been steeped for twelve hours in strong sulphuric acid. It seems " that desiccation is most fatal to their vitality, and there can be no doubt it is for " this reason that sheep are much less liable to staggers in dry seasons and on high " grounds, than when the season is wet or their feeding grounds are low and damp. " . . . . These eggs finding their way into drinking water, or adhering to " articles eaten raw, as bilberries or the stalk of the *Angelica*, are swallowed by " men. The hands are even liable to be infected from contact with the grass, so that " the eggs may easily be swallowed with ordinary food, or from the casual applica-

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Tapeworms are not the only injurious parasites which man may receive from the animals which he eats. Quite recently it has been discovered that a microscopical thread-worm, the so-called *trichina spiralis,* brings, perhaps not very rarely, the muscular flesh of swine into a state in which a small quantity of it, eaten raw, will suffice to destroy life;—viz.,—that the sexless larval trichinæ, which may be counted by hundreds in any small mass of the diseased muscle, will acquire their sexual development directly they reach alive the stomach of the muscle-eating animal; that, unlike the tapeworm (which commonly sends forth its eggs to hatch somewhere outside the body wherein it dwells) each trichina will breed swarms of young within the intestinal canal of its host; and that these innumerable young, migrating from the animal's intestinal canal to all parts of its muscular system, will create an amount of irritation which often is sufficient to kill. This result has been witnessed, not only among various lower animals whereon the experiment has been abundantly tried, but also quite indisputably in man.* And the danger to man is even greater than I have yet said. For pork, in order to be capable of carrying live trichina-larvæ into the stomach, needs not to be absolutely raw. Professor Leuckart, a distinguished experimenter on this subject, has found trichina-meat retaining much of its dangerous qualities even when it had to some considerable extent undergone both pickling and smoking.

" tion of the hand to the mouth." The plan on which Dr. Leared recommends that the dogs of Iceland should be treated is that they should all at one and the same time be dosed with *Kamala*, an Indian vegetable drug, which Dr. Leared describes to be a very efficient (as well as cheap and tasteless) remedy against tapeworm.

The scope of my report does not allow me to enter upon the history of the singularly interesting inquiries through which, during the last twenty years, the genesiology of parasitic worms has been gradually becoming clear to us. I would only venture to express my deep sense of the services which have been rendered to practical medicine, not less than to exact science, by the researches of Steenstrup, Van Beneden, Küchenmeister, Van Siebold, Stein, Leuckart, and others; and especially by those conclusive experimental investigations which are due to the example and suggestions of Küchenmeister.

* See especially in Virchow's Archiv, vol. 18, papers by the Editor and by Prof. Zenker of Dresden. Prof. Zenker incidentally mentions, that among 136 post-mortem examinations which he made during eight months of the year 1855, he found four subjects evidently affected with trichina. He gives in detail the case of a farm girl who died under his observation in 1860, killed by trichinæ. She had a month before been taking part with the other farm-servants in a particular pig-sticking and in the consequent processes, and had probably (according to what is said to be a not very unusual practice) taken an occasional pinch of the sausage-meat which she had to chop. She soon fell ill, and died in five weeks. Her bowels contained swarms of adult trichinæ, and the voluntary muscles throughout her entire body were colonized by myriads of larvæ. It appeared on inquiry that other persons who took part in slaughtering the same pig also suffered, and that, though none died, two were bed-ridden for weeks. Microscopical examination of products which were remaining of the slaughtered pig—ham, sausages, and black puddings—showed in them innumerable dead trichinæ. [While the present report is being printed, a contemporary number of Virchow's Archiv (vol. 27, p. 421) contains a paper by Dr. C. Tüngel of Hamburg, giving particulars of a case in which certainly one death was caused, and perhaps also a second death, as well as some not fatal illness, by the consumption of trichinous pork on board ship. Of the two deaths, one occurred on the 24th, the other on the 27th day after that on which the pig was slaughtered, and the consumption of its flesh begun.—July, 1863.]

(*b.*) As regards possible ill-effects from consuming, in a well-cooked state, the flesh of animals with *anthracic or anthracoid disease*, evidence is still imperfect ;—partly, no doubt, because extreme ill-effects do not generally result from such eating, but partly also because, till public attention is drawn to the subject, it must be difficult to trace to their true cause any ill-effects which are thus occasioned. Mr. Gamgee tells me that he has experimented on this subject,—and that dogs and ferrets, to which he has given (cooked) various parts of animals slaughtered during splenic apoplexy or parturition-fever, have died in consequence of the meal ; but, on the other hand, M. Renault—formerly Director of the Imperial Veterinary College at Alfort—is quoted,* as believing that meat from carbuncular animals is harmless. It seems to me that in this question, which concerns so many diseases and so many different stages of disease, somewhat extensive investigations are wanted, to fix accurately the limits between safe and unsafe consumption. But that human life may, under some circumstances, be endangered through the use of cooked meat derived from animals with anthrax, seems to be conclusively shown by the following case, with which Mr. Keith, Senior Surgeon of the Aberdeen Royal Infirmary, has favoured me. "In the first week of November 1840, on the farm of Mr " G——, near K——, in Aberdeenshire, a two-year-old quey was " observed to be unwell, supposed to be threatening the 'quarter- " 'ill.' She was in consequence slaughtered by the ploughman, " aided by a neighbouring blacksmith. On skinning the animal " the flesh generally presented a healthy aspect, except that here " and there, round, black, ecchymosed spots, quite circumscribed, " were visible over the carcase. When these patches were cut out " the meat seemed so healthy to look at, that the owner resolved " to salt it down as his winter mart, a portion of the animal being " reserved for present use. A boil of this beef was cooked next " day in a pot of broth to dine the whole family, consisting of 11 " individuals—father, mother, six grown-up sons or daughters, an " aunt, horseman, and housemaid. Of the 11, two, viz., the father " and the servant, did not partake of either the beef or the broth, " and these both remained well, while the other nine who partook " more or less largely of both were soon after seized with such " alarming symptoms of poisoning that a medical man was at once " called in. The symptoms he found most urgent were dead sick- " ness, with vomiting, great prostration of strength, soon followed " by looseness of the bowels. By active evacuants, followed by " the free use of stimulants, and that succeeded by quinine, " seven recovered in a few days, but one daughter died on the " fourth day, and the mother sank on the fifth, both in a typhoid " state. On the 12th of November 1840, the ploughman, James " Robertson, who slaughtered the said cow, and the blacksmith,

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* *See* Virchow in his Handbuch der Pathologie und Therapie, vol. ii. p. 97. *See* also Chevallier, Dictionn. des Altérations et Falsifications des Substances Alimentaires Médicamenteuses et Commerciales, vol. ii. p. 55.

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Alexander Andrews, who assisted him, were admitted into the Royal Infirmary of Aberdeen, under the care of Dr. Keith, both labouring under phlegmonous erysipelas of one arm each, with high fever and delirium. No wound or open sore could be detected on the ploughman's hand or arm to account for inoculation, but it was surmised that he had partaken of the meat; but in the case of the blacksmith, who had not tasted the meat, he pointed to a large malignant pustule on the knuckle of his left, much swollen thumb, and stated that he had cut that knuckle while in the act of skinning the cow. Gangrene seemed imminent in both arms, from the finger tips to the axilla, vesications having already risen at various places; free and deep incisions instantly relieved tension; hæmorrhage from the cut vessels soon subdued the febrile excitement. One smart calomel purge, and then recruiting. The one was dismissed cured at the end of 22, and the other at the end of 26 days. These parties communicated the whole circumstances of the case to the writer, and already, before they came to the hospital, the two victims were dead. It was further stated that the offal of the cow was cast into a dung-hill, to which two grown swine had access. These ate of it freely, were taken ill, and both died. These facts are to depend on. The one point on which I am in doubt is as to whether it was the mother or the aunt that was the second victim; but that two died there is no doubt. The affair created a great sensation in the district, and has hindered the repetition of any similar occurrence; but it is to be feared it has also led to the more early disposal of the sick cattle for slaughter, to be sent off to some distant market.” In a letter of further information which Mr. Keith has been good enough to write to me, answering various questions I had asked him, he says:—“I learn that the meat cooked was quite fresh, and healthy to look at, and that the fatal dinner was cooked *on the very day the animal was killed*, so that putrescency had nothing to do with the matter. I further learn that one of the females—the servant—had suspicion that it might not be safe to eat of the meat, and therefore it was that she abstained, and was safe, as already stated. The father habitually abstained from animal food, and did so that day, and escaped. One other of the females only took of the broth, and no beef, and escaped more easily than any of the others.” *

(*c*) As regards possible ill-effects from consuming, in a well-cooked state, the flesh of animals which have been suffering an *infectious fever*,—small-pox, typhoid fever, pleuro-pneumonia, or aphtha,—I have no inculpatory evidence worth quoting. And as regards the last two diseases, common as they are in this country, I am

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* Many cases, less circumstantially stated, but generally to the same effect as the above, may be found scattered in journals of veterinary medicine, especially in those of Germany, for the last few years, as well as in older publications. And cases are comparatively numerous where birds, dogs, pigs, and cats have died after taking even small quantities of the blood or offal of recently-slaughtered carbuncular animals.

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of opinion that the absence of evidence is enough to show that immediate ill-effects of any considerable importance do not ordinarily follow the consumption of the meat. Indeed it is certain that on various occasions meat of this description has been consumed on so large a scale that, if the meat had been immediately hurtful, the consequent mischief could not have escaped observation.* On the other hand, I must repeat that, till public attention is drawn to such subjects as these, it is difficult to prove connexions, which afterwards become evident, between evils and their latent causes. And particularly in this point of view I must advert again to the unexamined part of this question,—the doubt whether chronic ill-effects (which of course would be singularly difficult to trace) may perhaps result, when febrile meat—meat which necessarily is of modified chemical constitution—becomes a considerable element in diet. An opinion is sometimes expressed, that boils (perhaps with other like affections) are caused in the human subject by the consumption of such meat as I refer to. And though I have not yet found any fact which I can deem conclusive in support of this opinion, I must admit that the alleged connexion is not *primâ facie* impossible.

(*d.*) Before leaving the subject of cattle-diseases in their relation to the supply of meat, I must mention, as a danger incidental to the consumption of meat from diseased animals, that, in some cases, the meat may be injurious in consequence of the animal having been *excessively drugged during life.* Mr. Gamgee mentions cases, where animals recently drugged with arsenic and strychnia have been used for human food. He quotes a very striking case, reported nine years ago in Germany, to the effect that signs of poisoning arose almost as an epidemic among 321 persons who had eaten of the flesh of an ox, which during life had been dosed with tartar emetic, and had had perhaps two ounces of that drug; that, of the 321 persons who ate of the ox, 107 suffered, and one of them fatally, from violent gastro-intestinal disturbance; that antimony was chemically found both in the flesh of the ox, and in the interior of the person who died; and that doses of the flesh given experimentally to other animals produced signs of poisoning. Generally it might be expected that no drugging of an animal, in doses not sufficient to poison it, could render its flesh capable of acting as a poison on man.

In conclusion, lest I should seem to have ignored any important existing evidence on the subject of the dangers which are attributable to the consumption of diseased meat, I think it right to observe that, in popular discussions of this subject, and even in some of the medical writings which relate to it, sufficient care has not, in my opinion, been taken to separate two impor-

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* See instances, in the section which relates to food in Levy's Traité d'Hygiène.—I am informed that some years ago during an epidemic of cattle-typhoid (rinder-pest) in Bohemia, the poor people had the habit of digging up, for food, the carcases which the authorities had had buried, and that no harm was observed to result from this practice.

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tant questions,—the question of meat's being rendered *unwholesome by decomposition*, and the question of meat's being rendered *unwholesome by disease*. Among the cases which I see adduced as illustrations of mischief from diseased meat, are some which, for aught that appears, may only illustrate the well-known fact, that, even in presumably healthy meat, poisonous properties, different from those of common putridity, are sometimes developed by decomposition. And although, for the interests of public health it is desirable that cases of the latter kind (and indeed all cases of alleged injuriousness of food) should receive their due share of attention, yet, for the immediate purposes of the present discussion, they must of course be regarded as irrelevant.

With regard to that minor branch of the inquiry which relates to the MILK of diseased animals,—it appears that, in this country, the most important question is as to the wholesomeness of milk from *animals with aphtha*. Mr. Gamgee points out that on some occasions when aphtha has been prevailing among the cattle of a country, the human population in the same places has suffered from the same or from some similar disorder. And experiment* seems to have established as certain, that, at least under some circumstances, the human affection may be caused by the consumption of milk drawn from a diseased animal. It may be † that the frequency of such communications of the disease, as compared with the number of persons who (more or less) are consumers of milk, is not great. But the danger is one of which the public ought to be aware. Further inquiry is wanted to ascertain whether the allegation, which has been both made and contradicted, be true or untrue,—that the milk of aphthous cows, if used for food (especially by young children, who are likely to be the largest consumers of it) is apt to produce disturbance of the stomach and bowels.

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* More than 20 years ago Prof. Hertwig published particulars of such experiments performed by him on himself and two friends with the result of producing a very definite eruptive fever.

† See, on this side of the question, the Report which was made to the Préfet of the Seine by M. Huzard fils, in 1839, when aphtha was extensively present in the Paris dairies. Among his conclusions are these :— § 41. Quand la maladie a été
" connue à Paris comme maladie épizootique, il y avait déjà quelque temps qu'elle
" régnait ; elle était à son *maximum* sous le rapport du nombre des bêtes malades ;
" déjà le lait était consommé journellement, et cela, depuis le commencement de la
" maladie, sans que l'attention eût été appelée par quelque dérangement dans la
" santé publique.

" § 42. Dans les années 1810, 1811, 1834, et 1835, où la même maladie avait régné
" à Paris, il n'y avait eu aucune précaution prise pour interdire la vente du lait ; cet
" aliment avait été consommé comme dans les années ordinaires, et aucune épidémie
" n'etait apparue.

" § 43. Dans les provinces où elle régne depuis le commencement de l'année
" dernière, on n'a point interdit la vente du lait, et il n'y a eu aucun accident, aucune
" affection connue qu'on ait pu attribuer à la consommation de cet aliment.

" § 44. Le lait des vaches malades, donné au sortir du pis, aux porcs, aux veaux
" mêmes, n'a point eu d'inconvénient pour ces animaux, et si des veaux ont eu la
" maladie, il en est qui n'en ont point été attaqués après s'en être nourris exclu-
" sivement pendant un laps de temps assez considérable."—See Annales d'Hygiène Publique et de Médecine Légale, vol. 22, p. 296.

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Mr. Gamgee in sundry parts of his Report states his belief that a very large proportion of the disease which now habitually prevails among live stock in the United Kingdom, and which he estimates as proving fatal to stock to the immense pecuniary amount of "more than six millions sterling" per annum, *might by proper measures be prevented*;—viz.,—that the epidemic diseases are due entirely to contagion, originally foreign, against the introduction and spread of which our present precautions are, in his opinion, not sufficient; and that the most destructive endemic diseases are due, partly to local malaria which improved land-drainage would dispel, and partly to dietetic mismanagement of stock. Though it is not any part of my present duty to enter upon a consideration of the important questions which are here opened, I have felt myself bound to bring these parts of Mr. Gamgee's Report under their Lordships' particular notice.

V.—MISCELLANEOUS PROCEEDINGS.

V. Miscellaneous proceedings.

To complete my report of the proceedings of this department in the year 1862, I must add as follows:—

that correspondence relating to the administration of the law was had with the Poor Law Board, as well as with various local officers and private persons;

that correspondence relating to local outbreaks of small-pox was had with the vaccination-authorities of Mutford and Lothingland, Halifax, Redruth, Clifton, Aylesham, Truro, Easington, Sunderland, Bradford in Yorkshire, Bodmin, Barnet, Knaresborough, Keighley, and Erpingham;

that correspondence relating to local outbreaks of fever (chiefly typhoid) was had with the authorities of Cotton End, Bedford, Gunnislake, Over Darwen, Highgate, Wakerley, Rotherham, Llanelly, East Grinstead, Kettering, Preston, Godmanchester, Clifton, Barnet, and Manchester; and

that in three of these cases—those of Kettering, Highgate, and Rotherham, local inspections were made.

The most important of the single cases here adverted to was that of Rotherham; where the population, surrounded by the filthiest evidences of sanitary mismanagement, suffered a severe and long-continued epidemic of typhoid fever. Dr. Shearman, who at the time of the epidemic was officer of health for the district, informs me that the returns then made to him by local medical practitioners gave 2,271 cases of fever; but that also "there were quite as many—or more—cases . . . of a mild "character treated by charlatans, or had no medical attendance;" and that the deaths were 109. Reports relating to this epidemic, as well as to an epidemic of jaundice which followed it, have already been presented to Parliament.

JOHN SIMON.

APPENDIX.

I.—LOCAL INQUIRIES by DR. SEATON, DR. STEVENS, DR. SANDERSON, and DR. BUCHANAN into the state of PUBLIC VACCINATION in various Parts of ENGLAND and WALES.

I. Local inquiries as to Vaccination.

1. Parts of Kent, Hereford, and Wales, by Dr. Seaton.

1.—DR. SEATON'S SUMMARY of the RESULTS of his INQUIRY in certain UNIONS in KENT, HEREFORDSHIRE, and WALES.

THE unions inspected were 54, viz., 17 in Kent (completing the inspection of that county), one in Herefordshire (omitted in the inspection of 1860), and 36 in Wales. The number of Vaccinating-Districts in the 54 Unions was 208. I include among the Welsh Unions the Incorporation of Montgomery and Pool, although the parishes and townships comprised in it are not in union for purposes of public vaccination, but have to make each its own independent arrangements.

In all the unions and parishes, except five small townships in the Montgomery and Pool Incorporation, one or more medical practitioners were appointed to vaccinate at the public cost.

The following table shows the unions visited; and, with regard to each, (1) the number of vaccinating districts into which it was divided, (2) the number of public vaccinators appointed, and (3) the proportion which, on the returns annually made to the Poor Law Board, the infantile public vaccinations bore to the registered births for the years ending Michaelmas 1859, 1860, and 1861 respectively.

TABLE I.

Union.	Number of Vaccinating Districts in each Union.	Number of Contractors for Vaccination in each Union.	Infantile Public Vaccinations in Proportion to every 100 registered Births.		
			Year ending Michaelmas 1859.	Year ending Michaelmas 1860.	Year ending Michaelmas 1861.
West Ashford - -	3	3	50	65	48
East Ashford - -	5	5	48	68	50
Romney Marsh - -	2	2	69	55	50
Tenterden - - -	6	6	35	47	28
Cranbrook - - -	6	6	*	58	33
Tunbridge - - -	7	5	34	48	30
Sevenoaks - - -	6	6	50	56	63
Malling - - -	4	4	65	52	50
Maidstone - - -	6	6	40	36	30
Hollingbourne - -	6	6	65	84	63
Medway - - -	1	11	74	78	71
Sheppey - - -	2	2	45	52	38
North Aylesford - -	2	2	45	60	50
Hoo - - -	1	1	20	50	17
Gravesend and Milton -	2	2	52	41	60
Dartford - - -	5	5	36	35	37
Bromley - - -	3	3	22	25	18
Kington - - -	5	5	47	48	77
Hawarden - - -	2	2	87	62	68
Holywell - - -	5	5	68	67	66

* The return for this year was inaccurate.

Table I.—*continued.*

Union.	Number of Vaccinating Districts in each Union.	Number of Contractors for Vaccination in each Union.	Infantile Public Vaccinations in Proportion to every 100 registered Births.		
			Year ending Michaelmas 1859.	Year ending Michaelmas 1860.	Year ending Michaelmas 1861.
St. Asaph	5	5	—	*	—
Ruthin	3	3	30	34	32
Wrexham	11	11	62	74	73
Llanrwst	2	2	58	50	45
Conway	2	2	—	*	—
Bangor and Beaumaris	5	5	64	57	41
Carnarvon	5	5	26	27	27
Pwllheli	5	5	—	*	—
Anglesey	3	3	—	*	—
Holyhead	3	3	38	44	30
Festiniog	4	3	34	33	19
Dolgelly	4	4	19	54	26
Bala	1	1	20	28	7
Corwen	3	3	66	58	41
Machynlleth	5	5	30	36	33
Newtown and Llanidloes	4	4	—	*	—
Montgomery and Pool	14†	5	—	‡	—
Llanfyllin	5	5	36	38	23
Knighton	3	3	23	23	29
Presteigne	1	1	46	25	55
Rhayader	1	1	31	22	28
Aberystwith	3	3	28	8	12
Aberayron	2	2	23	28	29
Lampeter	2	2	20	18	47
Tregaron	1	1	—	*	—
Cardigan	3	3	43	28	36
Newcastle-Emlyn	3	3	65	53	35
Haverfordwest	4	4	21	42	26
Pembroke	4	4	62	57	45
Narberth	4	4	45	51	43
Carmarthen	6	6	30	61	45
Llandilo-fawr	4	4	61	61	61
Llandovery	2	2	55	54	55
Llanelly	2	1	74	76	65

The results of my inquiry I shall state under the heads of (1) the quantity of vaccination, (2) the quality of vaccination, (3) the arrangements made for public vaccination and the observance of the laws and regulations regarding it, (4) recommendations and suggestions made to local authorities, &c.

I.—QUANTITY OF VACCINATION.

Taking the unions collectively, the amount of infantile vaccination which had been performed was found to have been very deficient. 1. On examination of the registers of the vaccinators, it appeared that of the primary vaccinations performed by them in the three years 1859–61, less than two-thirds had been effected in infancy, *i.e.* within one year of age, and that of the infantile vaccination but a very small

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* The returns sent up from the unions of St. Asaph, Conway, Pwllheli, Anglesey, Newtown and Llanidloes, and Tregaron did not correspond with the registers of the vaccinators, or were in other ways ascertained not to be reliable.

† Parishes and townships; the five remaining townships in this incorporation have no public vaccinator.

‡ The parishes and townships in this incorporation make no return to the Poor Law Board.

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proportion had been done under the age of three months. 2. On personal inquiry as to the state of vaccination in 18,176 children in national, parochial, and other charitable schools and in workhouses, I found that 2,169, or 12 per cent., were without mark of efficient vaccination, and that 1,772 or 9·7 per cent. were on the days of inspection without any protection against small-pox ; 397 of the children who were without vaccination-marks having already suffered the consequences of their parents' neglect, and being more or less marked with that disease. In infant schools and the infant classes of mixed schools the proportion unvaccinated was 14 per cent., and the proportion unprotected 13·1 per cent.

The result of school examination was more favourable than that noted in the inspections of previous years.

Year.	All Schools.		Infant Schools only.	
	Per cent. unvaccinated.	Per cent. unprotected.	Per cent. unvaccinated.	Per cent. unprotected.
1860 - -	16	12·2	19	15
1861 - -	14	10·6	17·3	14·5
1862* - -	12	9·7	14	13·1

In 1860 and till the middle of 1861 the unions inspected had all been *selected* on account of the especially backward state of infantile vaccination indicated by the returns annually sent up from them to the Poor Law Board; but since July 1861 inspection has been carried on in districts. The difference in the results of school examination was therefore due in great measure to a larger proportion of comparatively well-vaccinated districts being included in the inspections of this than of either of the preceding years. But not altogether: for, in consequence of the prevalence of small-pox in 1858 and 1859 in most of the unions visited, an enormous amount of arrears of vaccination had at that time been disposed of; and in many districts in which there was the clearest proof of past neglect, as well as of recurring neglect, only a small proportion of the children attending school were found unvaccinated. In short, while a large proportion of unvaccinated in schools was clear evidence of neglect of vaccination in a district, a small proportion on the other hand did not necessarily show the regular and systematic maintenance of the practice of vaccination.

Unsatisfactory as these general results were, it was quite certain that there was a much larger amount of infantile vaccination now performed in the inspected unions than at any time previous to the year 1853. On the other hand it was very generally brought to my notice that

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* Distinguishing the Kentish from the Welsh Unions the result was as follows :—

Group of Districts.	All Schools.		Infant Schools only.	
	Per cent. unvaccinated.	Per cent. unprotected.	Per cent. unvaccinated.	Per cent. unprotected.
Unions in Kent - -	10·8	9·5	13·8	13·1
Kington and Unions in Wales - - -	12·7	9·9	14·2	13·2

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the amount had considerably declined from that performed in 1854 and 1855.

The districts may be conveniently divided into four classes.

1. In the first of these infantile vaccination was sufficient in amount, or nearly sufficient. Foremost in this class must be placed the district of Mold (population 14,577), in the union of Holywell. Through the kindness of Dr. Hughes, the public vaccinator, I am able to give, in the following abstract of the register of successful vaccinations, a complete statistical account of the vaccination of this district from the time the compulsory Act came into operation to September 30, 1862.

Years ending Sept. 30th.	Number of Entries.	Successful Vaccinations.		Left previous to Vaccination.	Died previous to Vaccination.	Now unvaccinated in District.		Deaths from Small-pox.
		Children born in District.	Not born in District.			Above Three Months.	Under Three Months.	
1854	422	387	6	12	17	—	—	—
1855	439	386	21	10	22	—	—	—
1856	436	380	18	10	27	1*	—	—
1857	452	393	18	13	28	—	—	—
1858	466	399	16	16	35	—	—	—
1859	499	417	27	7	48†	—	—	—
1860	482	396	16	14	54	2	—	1‡
1861	527	428	25	14	57	3	—	—
1862	577	331	25	10	34	42	115	—
Total	4,280	3,689		106	322	163		1‡

Children born before August 1st 1853 have not been included in the above table. The entire number of successful vaccinations performed by Dr. Hughes in the nine years comprised in it was 3,957. In all these but 376, the vaccination had been effected before the child was a year old.§

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* Has had small-pox.

† In the years 1859, 1860, and 1861, by an error on the part of the registrar, every entry from the register of births had been copied, whether the child was alive at the date of registration or not, hence the greater number of deaths entered in those years.

‡ An imported case. In 1857 and in 1858 also the disease was imported, being prevalent in adjacent unions, but it did not spread.

§ For comparison I subjoin the Statistics of the Vaccination of the District for the Six Years *preceding* the Vaccination Extension Act :—

Years.	Registered Births.	Successful Vaccinations.			Deaths from Small-pox.
		Under One Year.	Above One Year.	Total.	
1848	438	187	320	507	—
1849	393	161	86	247	1
1850	450	221	234	455	6
1851	422	144	95	239	—
1852	435	248	350	598	6
1853 to Sept. 30	300	220	218	438	7
Totals -	2,438	1,181	1,303	2,484	20

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The district of Tenby, in the union of Pembroke, was scarcely less perfectly vaccinated, for although, from the plan there adopted of spring and autumn vaccinations, a smaller proportion of children was vaccinated within the precise limits of age laid down in the statute than in Mold, vaccination was seldom delayed beyond the age of six, and scarcely ever beyond that of eight or nine months. Mr. Chater, the public vaccinator, had from the time of his appointment in 1856 considered it his duty to see that every child born in the district was duly vaccinated, lists of the births being with this view periodically given to him by the registrar. At the time of my inspection he informed me that up to and including the last list so received, there remained but 12 children born since his appointment, and still living in the district, unvaccinated.

I had not the same means of arriving at exact knowledge with regard to the state of other districts as of the foregoing. But there were several in which from the means employed, and upon comparison of the annual infantile vaccinations with the population, or (when they could be ascertained) with the actual births, I had every reason to feel quite certain that the insufficiency, if any, must be very trifling. And in such districts the few (born in the district) who were not actually vaccinated within the year from birth were vaccinated shortly after. Such districts were No. 3 in East Ashford Union (in which 92 per cent. of the total vaccinations were performed under one year of age, 86 per cent. under six months, and 75 per cent. under three months) ; No. 1 in Hollingbourne Union (90 per cent. under one year, 83 per cent. under six months) ; No. 1 in West Ashford, and No. 2 in Malling Unions (in each 90 per cent. under one year, 70 per cent. under six months) ; the Wittersham district in Tenterden Union (90 per cent. under one year, 60 per cent. under six months) ; the Pembury district in the Tunbridge Union (92 per cent. under one year) ; the Hawarden district of the Hawarden Union (91 per cent. under one year) ; district No. 1 of Llandovery Union ; and district No. 2 in the Pembroke Union.

Allowing for a little more delay as to age, I might include in this class some other districts in the Hollingbourne Union ; districts 1 and 2 in the East Ashford Union ; the Benenden district of Cranbrook Union ; one or two districts in the Holywell Union ; the Llanboidy district in Narberth Union ; some parishes in the Montgomery and Pool Incorporation ; and probably a few other districts. And in several districts, especially in Wales, in which there was proof of great neglect heretofore, infantile vaccination was now, under recently appointed vaccinators, becoming well and steadily maintained.

2. The second class of districts is that in which with a steady performance, and large annual amount of vaccination (nearly all of it infantile), there was yet proof that the amount was insufficient. The Medway, Wrexham, and Gravesend and Milton unions afforded illustration of this class ; in all of these, notwithstanding a high comparative rate of infantile vaccination,* there were evidences of insufficiency. In one part of the Medway Union as many as 20 per cent. of the children in the infant schools were unvaccinated. In the Gravesend Union, on occasion of a recent epidemic of small-pox (afterwards referred to), one of the public vaccinators took the pains to ascertain

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* From the plans adopted the public returns of the first two unions exhibit the whole, or very nearly the whole, vaccination, public and private, of the Union. In the Gravesend Union allowance has to be made for private vaccination ; nearly all the vaccination in the three unions was infantile, and much the greater proportion effected within six months of birth.

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by personal inquiry what the amount of private vaccination in the union was, and found after deduction for that and all other causes that from 10 to 15 per cent. of the births was still unaccounted for.

3. There were several districts in which vaccination was found to be regularly and steadily maintained, the annual rate varying little, and being such in amount that, *if it were compared with the births irrespective of the age at which the vaccination was effected*, it might have appeared sufficient, but in which a considerable proportion of the vaccination (amounting in some districts to a third, and in one even to the half,) was not performed in infancy, but at ages which extended sometimes to the second, third, or fourth year from birth, or even beyond. These districts were much in the condition of the Mold district *before the compulsory Act.* The Staplehurst district of Maidstone Union, Edenbridge district of Sevenoaks, both districts of North Aylesford Union, the Guildsfield district of Llanfyllin Union, the town and parish of Welshpool, and the upper district of Aberayron, belonged to this class.

4. But a large majority of the districts visited was, I regret to say, in the fourth or last class, which comprises those in which not only infantile vaccination was deficient, but the practice of vaccination altogether was very insufficiently and frequently very irregularly maintained. In at least one third of the unions inspected in Wales, and in a considerable number of districts both in other Welsh and in the Kentish unions it was certain that *not one half of the children born were vaccinated within one year of birth*, and that but a small proportion of the arrears was yearly cleared away. There were some districts, and many large parishes in this group, in which periods of two or three years elapsed without any public performance of vaccination.

In the unions of Ruthin, Holyhead, Carnarvon, Pwllheli, Festiniog, Dolgelly, Machynlleth, Bala, Llanfyllin, Aberystwith, Aberayron, Lampeter, Haverfordwest, in Wales; in districts 1 and 2 in Bromley Union, and in various other districts both in Kent and Wales, the amount of public primary vaccination performed above the age of one year in the years 1859–61 had largely exceeded, and had in some of them been twice or thrice the amount of public infantile vaccination. This large performance of vaccination above one year of age had not in most instances been spread over the three years, but had taken place in each district at some period or another when an outbreak of small-pox had caused alarm. A very large proportion of these vaccinations had been in children whose age varied from 2 to 7 years; but in Wales no inconsiderable proportion in children much older, and there were included also many adolescents and adults who had never before been vaccinated.* When the alarm caused by small-pox had passed away the neglect recommenced, and in many of the infant schools of these very districts, a fifth, a fourth, or even a larger proportion of the children were at the time of my inspection unprotected.

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* The neglect of vaccination in Wales, prior to the Act of 1853, had been extraordinary. With regard to the number of adults who were found unprotected at the time of the small-pox epidemic of 1858–9 I had most reliable testimony. And I had repeated opportunities of making personal inquiries which confirmed the statements made to me. The change which had been wrought in Wales by the compulsory Act, and by the knowledge of parents that they *might* be compelled to have their children vaccinated, was said to have been very great; and, in districts in which pains about vaccination had been taken, I was often called upon to note in schools the much larger proportion of elder children (born before the Act came into operation) than of younger children unvaccinated. In Holywell schools there were 19 children unvaccinated out of 141, but 12 of these were born before the Act. In Flint, 16 unvaccinated out of 225, but 9 of these born before the Act. Of 128 elder children in Denbigh, 31 were unvaccinated, but of 55 younger children, only 8, &c.

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It may be desirable to give a few details. In Ruthin Union vaccination had been greatly neglected. An outbreak of small-pox took place in 1857–8 which caused several deaths, and for a few months vaccination was performed in large amount. In district 1 (population above 7,000), after the alarm had subsided, two years passed with the performance of only 14 public vaccinations. At the end of this time a certain amount of vaccination was performed; after which there was again a lapse of 16 months without any performance of vaccination. In this district and also in district No. 2 the habitual age for vaccination was from 1 to 5 years, but many were not vaccinated till later. In one district in the union of Anglesey there had been no vaccination for more than three years till shortly before my inspection; 200 children had then been vaccinated, of whom only 17 were infants, and still there were above 20 per cent. of the children in the National and British schools unprotected. In another district in the same union (population above 10,000) out of 158 vaccinations performed during the year only 40 were infants; 20 per cent. of the children in the National school in this district were unprotected. In the Tremadoc district of Festiniog union (population about 8,000, and vaccination, as in all the districts above cited, entirely or nearly entirely public) there had been, since the small-pox outbreak of 1859–60, 28 vaccinations of infants in 1860–61, and 16 vaccinations at all ages in 1861–2. In Bala Union (population 6,352) the arrears of many years had been cleared away in 1860; the public vaccinations of babies in 1860–1 were 12, in 1861–2, 18.

One of the worst unions inspected was the union of Aberystwith. In the upper division, the population of which, exclusive of the town, exceeds 10,000, there had been but 84 public vaccinations at all ages in three years. Of children in a National (not infant) school in this district 24 per cent. had not been vaccinated. In the lower district (population above 8,000) there had been in 2½ years 20 vaccinations at all ages. In the town of Aberystwith itself, common to the two districts (population 5,149), the neglect was as scandalous: 35 per cent. of children in the infant school were unvaccinated, and for a year there had not been performed a single public vaccination.

I will add a few more illustrations, taken from the Kentish unions. In district No. 4, in East Ashford Union (population 4,055), there was found, on alarm of small-pox in 1859–60, an immense accumulation of unvaccinated children up to the age of 10 and 12 years, especially in the parishes in and close up to Romney Marsh. A large amount of vaccination was then effected, after which the district was left for 14 months without the performance of a single vaccination; and in five of the seven parishes which constitute the district there was none for nearly two years. In the union of Hoo, vaccination, since the cessation of small-pox in 1860, had been little more than nominal, and 28 per cent. of the children in the National school were found unvaccinated. In two districts of Bromley Union the neglect was excessive. In district No. 1 (population nearly 8,000), the public vaccinations above one year of age had in the three years 1859–61 been nearly double the infantile vaccinations; there had been in the 10 months preceding my inspection but 10 public vaccinations altogether, and some parishes had been without vaccination for two years; 33 per cent. of children in the infant school were unprotected. In district 2 (population 2,703) the vaccinations above one had been more than three times as numerous as the infantile vaccinations.

Examples of districts remaining for periods varying from one to three years without any vaccination were Rolvenden, in the Tenterden

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Union; Sandhurst, in the Cranbrook Union; Anglesey, No. 3, in the Bangor Union; Llanidan, in Carnarvon Union; Aberdaron, in Pwllheli Union; Llanegryn, in Dolgelly Union; Lower Aberayron, in Aberayron Union; Conwyl, in Carmarthen Union.

In the following districts the examination of children in schools showed the great neglect of vaccination which had prevailed, the figures in brackets exhibiting the per-centage of unvaccinated :—1. In infant schools and infant classes of mixed schools. Tunbridge Wells district of Tunbridge Union (23); Tunbridge district of the same union (32); Brenchley district of the same union (20); Crayford, in Dartford Union (22); Sheerness, in Sheppey Union (27); Tregynon, in Newtown Union (29); Llanidloes, in the same union (27); Lampeter, in Lampeter Union (37). 2. In National and in mixed schools, in which there were either no "infants" attending, or the infants were not examined separately. Sevenoaks, in Sevenoaks Union (23); Riverhead, in the same union (19); Denbigh, in St. Asaph Union (25); Llanidan, in Carnarvon Union (36); Llanfyllin, in Llanfyllin Union (21); Lower or Newquay, in Aberayron Union (23); Cardigan, in Cardigan Union (25); St. Dogmael's, in the same union (26).*

Besides information on the observance or neglect of vaccination which I could in the above ways acquire for myself, I had from the public vaccinators generally valuable information with regard to the state of their respective districts. Some of the registrars also were able to give me information of a more definite kind, as they made it a rule to inquire personally about the vaccination, removal, &c. of every child registered. Thus the registrar of the Pater or Pembroke Dock district of Pembroke was able to give me a complete account of his district from the time the Vaccination Extension Act came into operation; from which it appeared that there were 300 children between the ages of three months and three years in the district unvaccinated.† The registrars of Rhayader and the registrar of one of the districts in Llanrwst had exact lists of the unvaccinated in each parish, &c.

Causes of neglect.—1. *Indifference and apathy of people.*—Throughout the inspected districts the neglect of vaccination was ascribed, so far as the people were concerned, to their idleness, indifference, and habit of procrastination. To the inquiry I constantly made as to the existence of any positive opposition, the reply of

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* I subjoin a few examples, out of a large number I have collected, of the ages at which children were presented for vaccination in districts comprised in Class 4 :—

District.	Ages at which Children were vaccinated.				
	Under 1 Year.	1—2 Years.	2—7 Years.	7—12 Years.	Above 12 Years.
Corwen, central -	264	120	120	20	—
Presteigne - -	64	20	36	15	4
Lampeter - - -	105	66	179	—	—
Tregaron - - -	28	25	91	—	—
Milford - - -	207	129	101	27	21
St. David's - -	83	43	69	17	3

The registers of districts in the Dartford and other unions in Kent exhibited similar delay.

† Such information, when it can be had, is especially valuable. School examination gets hold of few children under the age of three years.

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at least nine-tenths of the vaccinators was that they were not aware of a single case; and those generally who had met with such cases said that the opposition was limited to individuals, though in about half a dozen instances particular *parishes* were named to me as containing many who were decidedly opposed to it. It did not appear, however, that the strength of the objection had in any of these instances been tested by legal proceedings. "They are all of them very glad to have it;" "excuses are handy, but no one objects;" "it is all idleness and sheer indifference; they put off as long as they can, or consent as a favour; but no one objects," "they put off, but they don't refuse;" "they're all for it; they have no objection, but they're very idle," are forms of expression which were used to me again and again, and which fairly represent the feelings of the people, as stated to me by medical men, by registrars, by schoolmasters, and by others of whom I inquired. Not, however, but that objections were sometimes urged by parents which, though not amounting to opposition to vaccination, led to delay, and required in dealing with them temper, management, and sometimes a little yielding on the part of the vaccinator. A feeling about eruptions following vaccination was regarded generally as a mere excuse for putting off, but sometimes really originated in some case which the vaccinator had to explain. Objection to be done with dry lymph, and a desire to wait for an arm, or even to wait for the arm of a particular child, cannot be put down to objection to vaccination itself, though they were undoubtedly in many instances real causes of delay.

The main cause, however, was the notion that so long as small-pox was not present there was no real necessity for vaccination, which interfered with their occupations, and made the children poorly. On this account many preferred it should be left until their children could run about. If they consented earlier, it was *out of kindness to the doctor*. It was admitted on all hands that those who had been foremost in their excuses were to be found among the most eager when small-pox was really present.

But the apathy and indifference of many was something far beyond this. Even when the disease was close by, unless means were taken to rouse and oblige them, they would sit still and "let the Lord's will be done."

There were several districts in Kent, as well as a very great many in Wales, in which the general favourable feeling with regard to vaccination was said to be of recent origin, and to have dated from the last epidemic of small-pox. The evidence the people then had of the protective value of vaccination had taken away, it was alleged, all their scruples.

But there was a prejudice still largely existing in Wales, of which I heard in, I think, every union without exception, as interfering more or less, and in many of them very considerably, with the satisfactory conduct of vaccination. It was the objection which parents entertained to allowing lymph to be taken from the arms of their children. To prevent this being done they would not only avoid taking their children for inspection, but they would sometimes take active steps by removing them, hiding them, or locking up their houses, to prevent the vaccinator having access to them. The feeling, however, was allowed generally to be on the decline, and in some districts to have worn out altogether.

2. *Bad Arrangements.*—But the defective state of vaccination which I have had to describe was largely due to the absence of proper opportunities for vaccination, especially for the vaccination most acceptable to the people; viz., that from arm to arm. I shall have by and bye to

describe the defective arrangements which I found extensively prevailing in the inspected districts. Cases were brought to my notice in which parents had gone once and again to vaccinators' houses, and to appointed places at appointed times, and had either not found the vaccinator at all, or had found him unable from want of lymph to perform the operation. In other cases, at times when vaccination was going on, and might have been had in a district, the people had no proper information regarding it. It was quite certain that, in all the districts in which vaccination was wholly suspended for long periods together, this had been owing to the district having been left without any proper means of vaccination. And it was the general belief of the registrars and others in the neglected districts, that if the medical men only made proper arrangements, and *kept to them*, they would find the people quite ready as a rule to avail themselves of them. The contrast between these districts and others in which regularity and system prevailed on the part of the vaccinators, or of the same district when under the hands of a painstaking and methodical or of a negligent vaccinator, proved this belief to be entirely well founded. Painstaking vaccinators who had succeeded to neglected districts, relating to me their experience, complained much of the negligence of their predecessor, and laid their difficulties with the people on his shoulders. "The people had got out of the habit of looking for vaccination."

3. *Special Causes.*—In particular districts the defective state of vaccination had been partly due to special causes; as to the personal unpopularity of the vaccinators; the employment of unqualified substitutes, &c. In some of the most neglected districts the registrar had omitted to give any notices of the requirements of vaccination.

4. *Absence of Systematic Supervision.*—In all the districts in which I had proof, or had reason to believe, that infantile vaccination was properly carried out there had not only been regularity and system on the part of the vaccinators, but either they or the registrars or both of them had made it their business to *look after* the vaccination, and to see that the children born in the district were duly vaccinated. Where supervision of this kind was wanting, the most perfect system of attendance, and the utmost regularity of the vaccinator had been productive but of partial results. On the other hand, the observations I have just had occasion to make show that supervision of the proper fulfilment of engagements on the part of contractors was found to have been to the full as much required as supervision of the discharge of duty by parents. I met with no instance in which a board of guardians had exercised supervision in either respect.

Boards of guardians had indeed at various times, and generally under fear of small-pox, taken action in furtherance of vaccination. They had in several instances issued public warnings; they had in two instances (Sevenoaks and Newcastle-Emlyn) caused personal notices to be served on parents shown by the "Registers of successful vaccination" to be in default; or they had, as in Hawarden and Narberth, caused notices to be sent to persons specially complained of. Since the Act of 1861, enabling them to appoint some person to take proceedings, the boards of Ruthin and Holywell had made appointments; and the boards of Maidstone and Medway had, without making a special appointment of prosecutors, resolved that in cases of default brought to their knowledge they would proceed. But actual proceedings had not anywhere been taken. From the communication I had with guardians it appeared to me to be entirely their desire that vaccination should be properly carried out, but systematic measures for the purpose had not hitherto been thought of or suggested to them.

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Proceedings in enforcement of vaccination had been taken in four districts by vaccinators or registrars, and in enforcement of return for inspection in two districts by vaccinators. The parents proceeded against for non-vaccination in every instance had their children vaccinated between the issue of the summons and the hearing. And the proceedings had never failed in the object which, through them was more particularly sought, viz., their effect on the vaccination of the district.*

Actual proceedings, it was allowed on all hands, would seldom be called for when parents were once made thoroughly to understand that they must observe the law. Dr. Hughes of Mold had not had to take proceedings in a single case, but he held that his task would have been hopeless if the people had not thoroughly understood that the power was in his hands and that he would not put up with any infringement of the law. Mr. Chater, of Tenby, soon after his appointment to his district in 1856, found it necessary to take proceedings in a couple of cases "simply that the people might understand that the law was not to be trifled with," but has found no occasion for proceedings since. And the present vaccinator of the southern district of Llandilo Union, appointed rather more than a year ago, finding the vaccination of his district in a state of complete disorganization on account of the irregular habits of his predecessor, took a case of refusal before the magistrates for the sake of example, and has had no trouble whatever since. In further proof of this my attention was particularly called to the state of the registers of successful vaccination in 1854 and for some time longer in unions in which there is now the greatest neglect, *e.g.* Bromley. The people in fact obeyed the law until they found its observance was not inquired into.

Workhouses.—The following table exhibits the state of vaccination of the children, above the age by which vaccination ought by law to have been performed, in 38 workhouses.†

TABLE II.—Showing the RESULTS of the EXAMINATION of CHILDREN in WORKHOUSES.

Union.	Number of Children examined.	Number without Trace of Vaccination.	Number with doubtful Trace of Vaccination.	Number of those unvaccinated or doubtfully vaccinated who had Marks of Small-pox.	Per Cent. of Children examined unprotected by Vaccination.	Per Cent. wholly unprotected on Day of Inspection.
West Ashford - -	42	10	2	3	28·8	21·4
East Ashford - -	51	4	—	1	8·0	6·0
Romney Marsh - -	24	3	—	—	12·5	12·5
Tenterden - - -	70	7	5	—	17·0	17·0
Cranbrook - - -	54	6	1	—	13·0	13·0
Tunbridge - - -	105	15	2	1	16·1	15·2

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* Their influence often extended beyond the district or even the union in which they took place. I was informed in Sheppey that the vaccination had been sensibly affected for a considerable period by proceedings which had been taken by the registrar in the union of Milton.

† Except in Sheppey and Carnarvon, where accidental circumstances prevented, I examined the workhouse children in *every* union which I inspected in which a workhouse existed. In nine unions in Wales there was either no workhouse or there were no children in the workhouse at the time of inspection. And in five other unions, also in Wales, the children (altogether less than 30) were attending some National or parochial school, and were seen along with the other children in the school.

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Table II.—*continued.*

Union.	Number of Children examined.	Number without Trace of Vaccination.	Number with doubtful Trace of Vaccination.	Number of those unvaccinated or doubtfully vaccinated who had Marks of Small-pox.	Per Cent. of Children examined unprotected by Vaccination.	Per Cent. wholly unprotected on Day of Inspection.
Sevenoaks - - -	95	5	2	—	7·3	7·3
Malling - - -	86	12	—	—	14·0	14·0
Maidstone - - -	120	16	2	2	15·0	13·3
Hollingbourne - -	65	8	—	1	12·3	10·7
Medway - - -	157	21	2	8	14·6	9·5
North Aylesford - -	55	2	—	1	3·6	1·8
Hoo - - - -	14	1	1	1	14·3	7·1
Gravesend and Milton -	52	4	—	2	7·8	3·9
Dartford - - -	53	6	1	1	13·2	11·3
Bromley - - -	41	3	1	1	9·7	7·3
Kington - - -	38	12	1	1	34·2	31·6
Holywell - - -	67	7	1	1	12·0	10·4
St. Asaph - - -	45	6	—	—	13·3	13·3
Ruthin - - -	42	7	1	2	19·0	14·3
Wrexham - - -	74	7	2	—	12·1	12·1
Conway - - -	27	3	1	1	15·0	11·1
Bangor and Beaumaris -	34	6	—	4	17·6	5·9
Pwllheli - - -	17	3	—	—	17·6	17·6
Dolgelly - - -	5	3	—	1	—	—
Llanfyllin - - -	72	15	4	5	26·4	19·4
Newtown and Llanidloes -	48	8	3	2	23·0	18·7
Montgomery and Pool -	38	2	2	—	10·5	10·5
Knighton - - -	24	4	—	—	16·6	16·6
Aberystwith - - -	12	4	—	3	33·3	8·3
Cardigan - - -	21	7	1	1	38·0	33·3
Haverfordwest - -	77	14	2	2	20·8	18·1
Narberth - - -	38	7	1	2	21·0	15·8
Llandovery - - -	11	2	—	—	18·1	18·1
Llandilo-fawr - -	32	5	1	3	18·4	9·2
Llanelly - - -	32	5	—	1	15·6	12·5
Carmarthen - - -	35	6	—	4	17·1	5·7
Pembroke - - -	61	3	—	3	5·0	—

It will be seen that above 12 per cent. of the children in the aggregate were without protection against small-pox. In some of the workhouses great care had been taken about the vaccination, the children found unprotected being altogether or for the most part either only just above the legal age (as the two children in Llandovery), or children whose vaccination had been postponed on account of their health (as in Gravesend, &c.), or children recently admitted into the workhouse. But when proper deductions have been made on these grounds the result was unsatisfactory, and it was impossible to say with regard to the majority of workhouses that due care had been bestowed on the vaccination of the children. Children born in the house, and continuing in the house, were left till they were a year or two old, or were even transferred to the school, unvaccinated; and proper means were scarcely ever taken to ascertain the condition of children, as to their vaccination, on their admission to the house. Thus many were found unprotected who had been inmates for years.

CONSEQUENCES OF NEGLECT. SMALL-POX.—The neglect of vaccination had led to a considerable amount of small-pox mortality in many of the unions inspected. The deaths from this cause occurring in the four years 1858-61, in all the unions visited, are shown in the following table. During 1862 small-pox was not known, at the time of my inspection of each union, to have been present in any except the union of St. Asaph. In this union the disease had for some months been more or less prevalent in the town and district of Denbigh. The number of cases which had occurred had been, so far as I could ascertain, from a dozen to 20, some of them modified cases in vaccinated individuals, but some severe in unvaccinated individuals, but no fatal case had occurred. Much vaccination had taken place, but there were still undoubtedly many unprotected, 14 per cent. of the school children in Denbigh being in this condition. I gave suitable recommendations to the guardians. The alarm had caused vaccination to be carried out very completely in other districts of the union, as St. Asaph and Rhuddlan, in the latter of which there had been much irregularity and neglect; and its influence had extended also to the adjacent union of Ruthin.

TABLE showing the MORTALITY from SMALL-POX in the Inspected Unions in Four Years, 1858–61.

Union.	Deaths from Small-pox.			
	1858.	1859.	1860.	1861.
West Ashford - -	—	2	6	1
East Ashford - -	—	—	—	—
Romney Marsh -	—	1	—	—
Tenterden - -	—	—	—	—
Cranbrook - -	—	—	1	—
Tunbridge - -	—	2	6	—
Sevenoaks - -	1	4	1	2
Malling - - -	5	6	1	2
Maidstone - -	11	17	3	2
Hollingbourne -	1	3	—	—
Medway - - -	33	6	5	2
Sheppey - - -	—	—	—	1
North Aylesford -	—	2	4	2
Hoo - - - -	—	—	9	—
Gravesend and Milton - - -	—	—	3	12
Dartford - - -	7	8	8	1
Bromley - - -	—	2	4	4
Kington - - -	—	—	—	—
Hawarden - -	—	2	—	—
Holywell - - -	1	—	1	—
St. Asaph - - -	4	—	—	—
Ruthin - - -	10	—	—	—
Wrexham - -	13	—	—	2
Llanrwst - -	—	2	11	—
Conway - - -	—	6	1	—
Bangor and Beaumaris - - -	28	18	8	1
Carnarvon - -	2	56	10	—
Pwllheli - - -	—	3	14	—
Anglesey - -	4	—	6	1
Holyhead - -	—	6	—	—
Festiniog - -	—	7	7	—
Dolgelly - - -	4	—	1	—
Bala - - -	—	—	2	—
Corwen - - -	3	—	2	—
Machynlleth - -	1	—	4	—
Newtown and Llanidloes - - -	7	—	—	—
Montgomery and Pool - - -	5	2	—	1
Llanfyllin - -	6	3	—	—
Knighton - -	2	—	—	—
Presteigne - -	1	—	—	—
Rhayader - -	—	1	—	—
Aberystwith - -	1	11	44	19
Aberayron - -	1	22	11	10
Lampeter - -	6	26	3	—
Tregaron - -	4	13	—	—
Cardigan - -	13	—	—	—
Newcastle-Emlyn -	14	3	—	—
Haverfordwest -	65	24	—	—
Pembroke - -	44	26	—	—
Narberth - -	8	5	—	—
Carmarthen - -	111	36	1	1
Llandilo-fawr -	12	3	—	—
Llandovery - -	18	10	1	—
Llanelly - - -	68	14	—	—

On the mortality here exhibited I have two observations to make.

1. Although in these unions generally, as in all previous inquiries, it was found that the weight of mortality had fallen on young unvaccinated children, there was in the Welsh unions a larger proportion of adult mortality than I had hitherto met with. This was undoubtedly due to the great neglect of vaccination in past years to which I have already referred. All the deaths recorded as having occurred in the Lampeter Union were in a district in which, till of late years, vaccination was quite the exception, and 19 out of the 35 were adults; 17 of the deaths in the Aberayron Union were in the parish of Llanarth (population only 2,338), to which the same observations apply, and 10 of these were in adults; and of 15 deaths in Tregaron Union 9, of the 17 in Newcastle-Emlyn 9, and of the 31 in Llandovery 19, were in adults.

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In all districts of these unions vaccination is now carried out to an extent formerly unknown; in all but one, still very imperfectly. But in this exceptional district (No. 1 of Llandovery), in which the vaccination of children in early infancy has for years been systematically maintained and the vaccinator was prompt on the occurrence of small-pox to supply any accidental defect so far as it could be ascertained, the mortality was all but exclusively among adults. Thus, of the 31 deaths which occurred in the two districts of Llandovery Union, only seven were in the district referred to, and six of these were adults.

2. The second remark is, that notwithstanding the previous neglect of vaccination, the excessive amount of mortality exhibited in many of the unions might have been prevented after the small-pox had appeared by proper administrative activity. The activity of the vaccinators did in fact, in many most neglected districts, either arrest the disease at its outbreak (as in districts of Cranbrook, Romney Marsh, Rhayader, Corwen, Bala, &c.), or limit its spread and render the mortality comparatively trifling (as in the unions of Sevenoaks, Tunbridge, St. Asaph, Machynlleth, Dolgelly, &c.). But in the unions which suffered most (Carnarvon, Aberystwith, Haverfordwest, Pembroke, Carmarthen, Llanelly), no proper measures of arrest were employed, although (and this is the point of practical importance) there was time to prevent the serious extension of mischief. For example, the mortality exhibited in the Carmarthen Union was chiefly in the town and district of Carmarthen. But the disease had existed in one of the rural districts of the union, and thus given warning of its approach, for some time before any case whatever had occurred in the Carmarthen district; and when at length it invaded that district it progressed at first but slowly. The earliest cases were in February 1858: in March there were two deaths, one in April, two in June, three in July. By August, when the monthly mortality rose to nine, it was certain that no time was to be lost. But nothing was done; matters were allowed to take their course, and in the next three months there were 55 deaths, all but eight of which were in young children. So also the small-pox was for some time in the union of Aberystwith before it reached the town; it it was for some weeks in the town before it began to spread; it then continued fatally prevalent there for three months, every death which took place, with four exceptions, being in young children who were unvaccinated. In Carnarvon Union six-sevenths of the mortality was in the town and district of Carnarvon; there had been the same warning of approach, the same gradual progress at first, and the same supineness. There were 60 deaths in this district, 58 of which, as was ascertained by the registrar, were in children and persons who had never been vaccinated. It is lamentable to think of the amount of life which in these and other districts was thus literally thrown away.

The union of Gravesend, on the other hand, offered a good illustration of an epidemic vigorously dealt with. In this union great attention had been systematically given to vaccination by the public vaccinators; but when small-pox broke out there were many arrears. Upon the representation of the public vaccinators the guardians issued a cautionary notice; and a further notice was subsequently put out on receipt of a communication from the Lords of the Privy Council. The school managers insisted on the vaccination of all children in the schools; and the inspector of police made active and careful personal inquiries, founded on the birth registers and on his local knowledge, as to the existence of unvaccinated children. The total deaths which occurred during the epidemic were 15; but, of these, five were adults, three children born before August 1, 1853, and three children under

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three months old, two of which were born at the time their mothers were suffering from the disease. There were only four deaths of children illegally unvaccinated.

II.—QUALITY OF VACCINATION.

In inquiring into the quality of vaccination which had been current in the inspected districts I examined the cicatrices on the arms of 15,950 vaccinated children. The general result is given below :—

Vaccine Marks.	Excellent.	Passable.	Bad.	Total.
Four or more - -	1,310	574	242	2,126
Three - - - - -	2,241	855	368	3,464
Two - - - - -	3,745	1,610	690	6,045
One - - - - -	2,475	1,184	656	4,3 5
Total - -	9.771	4,223	1,956	15,950

Classifying the cases in four degrees of protection in the manner adopted in my former reports, the results are :—

		Per cent.
1. Best protected (having more than two typical marks) -	3,551 -	22·2
2. Well protected (having two typical marks) - -	3,745 -	23·5
3. Moderately protected (having one typical or two or more passable marks) - - - -	5,514 -	34·6
4. Badly protected (having bad marks or only one passable mark) - - - - - -	3,140 -	19·7

Thus not half the children vaccinated could be considered really well protected against small-pox. In nearly 2,000 children the protection depended on marks which had the vaccine character very imperfectly developed, 656 having but one such imperfect mark, while upwards of another thousand had to rely upon a single mark which could not be called more than passable.

The production of a number of vesicles had received more attention in the unions of Kent which were included in this year's inspections than in any other group of unions which I have visited. More than 50 per cent. of the children seen had at least three vaccine cicatrices. In Wales, on the other hand, although I made due allowance in counting for the large size of the cicatrices seen in several districts,* the proportion did not exceed 22 per cent. The proportion of children having a single cicatrix of average size was in Kent less than a sixth, in Wales more than a third; while in the former group of unions 30 per cent. of the children were in the highest degree of protection, in the latter only 16·4 were in this class. But the superior relative position of Kent was due entirely to *amount* of marking; the proportion of children in whom the mark exhibited the perfect *character* was rather highest in Wales.

Number of Marks.—The amount of marking had of course depended much on the number of vesicles which the respective vaccinators had desired to produce Many had deemed one sufficient, most had been satisfied with two or three. But the deficiency also depended, and in no inconsiderable degree, on the failure of vaccinators to produce the

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* *i.e.* when a cicatrix occupied the space of two average cicatrices it was counted as two, &c. &c. Many such cicatrices were seen in Wales in the practice of vaccinators who scarified over large surfaces.

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results at which they aimed; and this was especially observed in dry-lymph districts. In many such districts in which the character of the marks left no doubt of the goodness of the lymph employed, it was found that the number was short of that which it had been endeavoured to produce; and this deficiency was observed to a still greater extent in districts in which the lymph, besides having been used dry, appeared from the character of the marks to have been deficient in activity.*

Character of Marks.—The character of the marks had depended all but entirely on the skill and care of the vaccinators and the lymph used in vaccinating, the influence of all other causes being of so trifling a relative amount that it may be put out of consideration altogether. There were many vaccinators in whose practice children having second-rate marks, still more children with imperfect marks, were of rare occurrence. Generally, when such children were seen in these districts it was ascertained that they had been vaccinated by some one else, or had come from elsewhere. Some of the vaccinators whose work I saw, foremost among whom I may name Mr. Rathill of Westerham, Dr. Dunhill, former public vaccinator of Cranbrook, Mr. Weeks of Brompton, Mr. Langston of Strood, Mr. Williams and Dr. Davies of Holywell, Mr. Edwards of Denbigh, Mr. Ellis of Bangor, Mr. Mansell and Mr. Jones of Pembroke, Mr. Llewellyn of Newport, Mr. Rowlands of Tregaron, vaccinated children in such a way that the cicatrices they presented were almost invariably perfect, resembling in size as well as character those which I have seen in persons vaccinated by Jenner and the early vaccinators. Were all vaccinators instructed to this point, and did all take the same pains, the vaccination of the country could undoubtedly be brought to the same standard. As it was, the vaccination in few other districts was as perfect as in those I have named: although in many the results, if less uniformly excellent, were still highly commendable. But the number of districts was considerable in which the marks exhibited were in very large proportion indeed of a second-rate and imperfect character. The difference in passing from district to district was most striking. Contrast, for example, the district of Mr. Rathill, where the cicatrices, sufficient in number, had the most perfect typical character in 63 out of 67 children seen, were fair in 3, and bad only in one, with such districts as the following: A. "Of 200 "children, 60 had marks only passable or bad; in several the marks so "imperfect that the children required revaccination at once; several "of the unvaccinated said they had been tried." B. "A large proportion (20 out of 45) had either second-rate or inferior marks; two-

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* I subjoin, in illustration of this point, a few examples of the proportion which in some dry-lymph districts the number of cicatrices observed in children bore to the number of insertions which *at the least* the vaccinator stated had in all instances been made:—

District.	Number of Insertions of Lymph at the least.	Number of Children seen.	Having three or more Marks	Having two Marks.	Having one Mark only.
a.	4	103	30	36	37
b.	2	102	—	62	40
c.	3	54	12	21	21
d,	2	87	5	43	39
e.	2	71	—	39	32

In another district in which always 4 or 5 insertions were made, there were only 52 out of 220 children who had as many as 3 marks, &c. &c.

" thirds of the children had one mark only." C. " Nearly half the " children had only passable or bad marks." D. " In about half the " children seen (35 out of 71) the marks were second-rate or bad." E. " In not more than a dozen out of 120 children seen was there more " than one mark ; in about half, this was either second-rate or imperfect in character." F. " But 71 out of 168 children had typical " marks, and these were in many below the average in size. Other " marks were superficial and little dotted ; some faint, so as hardly to " be discernible." In one district I took for comparison a number of elder children who had been vaccinated by a former public vaccinator, and found that out of 24, 19 had perfectly typical marks, while of 63 vaccinated by the existing public vaccinator, only 28 had typical marks. And this by no means represented the entire difference, one typical mark of the former being, from its size, worth two at least of the latter. In many other districts I was able to make similar comparisons.

I ascertained of 171 vaccinators their present plan of performing the operation. Of 63 vaccinators in Kent 47 operated by puncture, 16 by scarification or abrasion : 39 made four punctures or equivalent scarification ; 18 three ; 6 two. No vaccinator in Kent attempted to produce less than 2 vesicles. Of 108 vaccinators in Wales, 53 operated by puncture, 55 by scarification or abrasion ; 27 made four or more punctures, or aimed at equivalent results ; 37 made three ; 33 made two ; and 11 made only one. This, in the practice of several vaccinators, represented an increase on their former number of insertions.

I found puncture and scarification each producing marks of fine or of second-rate or inferior quality, according to the hand that made them. But comparing on the whole the quality of the marks in the districts where scarification had been in vogue with those in which the operation had been performed by puncture, I have no hesitation in affirming that the advantage was with the former.*

From the imperfect way in which the registers of the vaccinators were usually kept, and the disregard of the instructions in respect to them, I was only in a few instances able to ascertain with precision what had been the success of vaccinators. In three districts in which at least nine-tenths of the vaccination was said to be done from arm to arm, there had been on 2,445 operations 69 failures, or less than 3 per cent. ; in six districts in which at least nine-tenths of the vaccination was said to be done with dry lymph on points, there had been on 1,459 operations 193 failures, or upwards of 13 per cent. In a district, not included among the above, I had an opportunity of comparing the success of the same vaccinator in two of his parishes, in one of which the vaccination had been performed from the arm by assembling the children, in the other from house to house. In the former, out of 89 vaccinations there had been two failures ; in the latter, of 99 vaccinations 20 failures. Vaccinators repeatedly told me of having to vaccinate children two and three times before they would take, and I was constantly meeting with children who had been vaccinated two and three times, and who after all had not taken. One dry-lymph vaccinator, who worked by single puncture, told me he had often to operate four

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* In one district I saw some magnificent marks the result of deep puncture, and other marks much smaller and less perfect in character, the work of the same vaccinator, by superficial puncture. He has abandoned now the latter plan on account of its unsatisfactory results. A superficial make-believe sort of puncture was in vogue in many districts, half a dozen marks from which did not cover the space of more than two proper ones. Some of the marks produced by abrasion, when the abraded surface was small, were no better.

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or five times, and his register bore this out, for it appeared that in one year of 155 operations only 109 had resulted in success, and in another year of 171 only 77. The Chairman of a board of guardians told me that the people complained much, "they got such a bad pock," by which it appeared they did not mean any bad consequences from vaccination, but simply that the operation was so often ineffectual.

I have already stated that in these dry-lymph districts, success when obtained was often only partial, two or three vesicles arising from four or five insertions, one or two only from three or four, and so on. Yet, under the plans adopted for the performance of vaccination, vaccinators, who when vaccinating from the arm made several insertions, stated their frequent inability with dry lymph to *allow* a child more than two points: they could not afford the lymph. The poor children were thus placed under a double disadvantage. Under these circumstances the extent to which the vaccination of the country is now carried on with dry lymph becomes a matter of very serious importance.

Success, especially success in producing the best results of vaccination, could not also but have been materially affected by the want of opportunities for selecting lymph under the plans described to me: Vaccinators constantly depending on single cases for the maintenance of their lymph, and being frequently placed in this difficulty that they must either suspend their operations altogether or take from a second-rate vesicle. And it was mentioned to me by various vaccinators as within their knowledge, though not within their practice, that lymph was repeatedly taken at late periods of the vesicle.

III.—ARRANGEMENTS FOR THE PERFORMANCE OF PUBLIC VACCINATION AND OBSERVANCES OF STATUTABLE AND CONTRACT DUTIES.

The provision made for public vaccination in the unions inspected will be conveniently described under the heads of, 1, Division into districts and appointment of vaccinators. 2. Attendances directed for the performance and inspection of vaccination. 3. Notifications regarding these attendances. 4. Performance of other contract and statutable duties, (*a*) by contractors, (*b*) by registrars.

1. *Division into Districts and Appointment of Vaccinators.*—Six of the unions inspected (vide Table I.) were undivided into districts, viz., Hoo and Medway in Kent; Bala, Presteigne, Rhayader, and Tregaron in Wales. In all these, except Medway, there was one public vaccinator for the entire union. In the Medway Union 11 medical gentlemen discharged the duties of public vaccinators.

The other unions were divided into districts, which, in all except Aberystwith and Wrexham, were co-terminous with the districts set out by guardians for the medical relief of the poor:* and for each district there was a public vaccinator appointed.

But in many of these districts, though vaccinators had been appointed and were receiving pay, no legal contract had ever been made. Such was the case in one district of East Ashford Union; one of Tenterden Union; two of Malling Union; two of Tunbridge Union; one of North Aylesford Union; two of Maidstone Union; two of Medway Union; three of Kington Union; three of Bangor Union; three of Carnarvon Union; three at least of Wrexham Union; one of Haverfordwest Union;

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* In all unions and districts, except the union of Presteigne, one district of Romney Marsh, and one of Haverfordwest, the district medical officers were the contractors for vaccination; and in all except the foregoing, and the unions of Medway, Wrexham, and Aberystwith, they were *exclusively* contracted with.

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two of Llandilo Union, and five of Carmarthen Union.* In three of these districts the vaccinators appointed had not the qualification required in contractors for public vaccination ; and in several of these districts either no arrangements for the performance of vaccination had been made in conformity with the statutes, or an arrangement had been made which was contrary to the statutes.

The division adopted had operated disadvantageously in Medway, Wrexham, and Gravesend unions, and in those parts of Maidstone Union within which the town of Maidstone is comprised. In Maidstone and Gravesend, by the establishment of two stations where the numbers to be vaccinated were not more than enough to maintain one in full efficiency, the continuous succession of arm to arm cases was interfered with, and the opportunities for selection were greatly diminished. The much greater sub-division in Medway and Wrexham had not only led in a much greater degree to the same results, but, together with the competition which was permitted, had further led to the performance of much of the so-called public vaccination at the dwellings of the people. Throughout the Wrexham Union, indeed, stational vaccination was all but entirely abandoned.†

2. *Attendances for the Performance and Inspection of Vaccination.*—In all contracts there were places and times appointed at which the vaccinator was bound to attend 'then and there to vaccinate' any applicant. The attendances were daily, weekly, monthly, in alternate months, or quarterly. The daily attendance was never directed except at the vaccinator's own residence. But even here it was entirely a fictitious and illusory arrangement. Some contracts, indeed, had been so drawn that any serious observance of the obligation could never from the outset have been intended, as where vaccinators (the district officers of extensive districts having no qualified assistant or appointed deputy) undertook to be at home 'from 10 to 1 daily' ; 'from 10 to 3 daily' ; 'from 10 to 4 daily,' &c., &c. But in fact when the hours named in the contracts were those at which, under ordinary circumstances, the medical men would be at home, I could not find that any considered themselves under any real obligation to remain within, nor to be ready 'then and there to vaccinate.'‡

Weekly attendances at the surgeries were given, and stations of greater or less efficiency maintained at Llanelly, Hawarden, Mold, Bangor, Welshpool, Carmarthen, Tunbridge Wells, Tunbridge, Ashford, Sheerness, Maidstone, Gravesend, by three or four of the contractors of

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* In this enumeration I have included those districts only in which it was the positive statement of the clerk of the union and the vaccinators that no contract had ever been made ; but there were several other districts in various unions in which contracts were not forthcoming, and in which there was a doubt whether any had ever been entered into.

† Nothing could be more disadvantageous than the plans adopted in these two unions. In Medway, with its large and closely aggregated population, two or three stations for public vaccination, of first-rate efficiency, might have been maintained ; but a first-class station was not to be found. There were two or three tolerably efficient ones ; but to a number of children in the union the benefit of arm to arm vaccination was entirely lost. In Wrexham Union nearly all the vaccination was carried on with dry lymph. Competition in this union had given rise to every sort of irregular practice. One vaccinator had had a druggist for his substitute ; but this had been stopped. Unqualified assistants were however sent about ; and more than one case was brought to my notice in which certificates of the successful vaccination of the same child were received by the registrar from two medical practitioners within a few months, it being proved that neither of these had ever seen the child.

‡ I ought to except one of the vaccinators of Gravesend, who said that in point of fact he always was at home every morning, and that he always kept lymph in capillary tubes.

Medway, and at out-lying stations in Hawarden and Mold districts, and at Pembroke Dock. A vaccinator of parts of the Malling and Tunbridge unions gave his weekly attendance at the surgery regularly, though often fruitlessly, but always prepared to vaccinate. With these exceptions the weekly attendance was no more regarded than the daily attendance, and for the same reason, viz., that the attendances required were wholly disproportionate to the numbers to be vaccinated, often indeed were double or triple the number of births.

Some of the stations I have named were excellent stations. And at all, the children, with few exceptions, had the benefit of arm to arm vaccination. At all, except Medway, the vaccinators were careful to maintain their stations as efficiently as possible by not vaccinating children at their dwellings.

Attendance according to contract, monthly, on alternate months, or quarterly, which was the plan usually laid down for rural districts and the rural portions of mixed districts, was said to be observed in the whole or part of 15 of the inspected districts. In four of these, in which the contract plan was entirely relied on, the vaccinators being men of great punctuality and system, the numerical result was good, but the plan was described as giving a large amount of fruitless attendance, and it had led to the performance of nearly all the vaccination with dry lymph. In parts of two other districts in which the plan was altogether relied on, the numerical results had been unsatisfactory. In the remaining districts other plans had been combined with the contract plan, especially the vaccinating at their own dwellings children known to the contractor who had not been brought to the station. This plan, wherever it was pursued, was tending to the destruction of stational vaccination; and in none of the districts in which it was followed was so much as one fourth of the actual vaccination of the district done at the stations. The amount of fruitless attendance may, therefore, be conceived, and all the vaccination performed at the stations in conformity with the contract was with dry lymph.*

With the exception of the districts, or parts of districts, above mentioned, the contract arrangements were disregarded.

Excellent plans had in various districts been substituted for the arrangements thus abandoned. At regular periods vaccination was systematically carried on from week to week. When this was done, as was the case in many districts, by assembling the children at the vaccinator's house or at an appointed place in their respective villages or elsewhere, children living in small towns and rural districts had the same advantage of arm-to-arm vaccination as though they had lived in a large town. This advantage was necessarily lost in other districts in which the vaccination was performed at the separate dwellings.

But much more frequently no systematic plan had been adopted. At irregular and uncertain times, and often at very long intervals, vaccinators went, or sent their pupils and assistants, through their districts, or parts of their districts, to vaccinate such children as they could lay their hands on; the children being either assembled as above at appointed places, or, very much more frequently, visited and vaccinated at their separate dwellings.

The extent to which, in this and previous inspections, I have found vaccination of children at the public expense at the dwellings of their parents practised caused me carefully to inquire into what its working had been.

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* Except in Llanelly, where the attendance at outlying stations was for three successive weeks every quarter.

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1. For reasons which are obvious, wherever the plan had been generally introduced it was either in process of extinguishing or had already extinguished stational or public vaccination.

2. Of the districts in which this had been accomplished, and which had, therefore, nothing else to rely on than the visits of the vaccinators, there were very few indeed in which I found these to have been made on any thorough and complete plan. The means of public vaccination being taken away, it was obviously necessary that means of vaccination should be separately offered to at least every child born within the district, and this was actually done in some of the districts which I have classed as numerically well-vaccinated. But, excepting these few instances, nothing of the sort was attempted, and the area and population of most districts would have rendered the attempt simply impossible. Even to the extent to which the visitation was carried the vaccinator considered himself at liberty to consult his own leisure, and nine times out of ten vaccination "from house to house" really meant no more than this, that such children as had been vaccinated had not been done at stations but at home. The most neglected of all districts were the so-called house to house districts.

3. But actual house to house visitation had by no means always resulted in the vaccination of the children. Parents in many cases could not understand that the doctor should be so anxious about vaccination but for some great advantage he was to get out of it, and they were minded that at least he should have a bit of trouble for his money; so they made him repeat his visit two or three times, till at last perhaps he got tired of it. Dr. Pinyon, of Benenden, who had succeeded in getting his children vaccinated, had often, he said, to call two or three times. But Mr. Jones, of Conway, was less successful; there was a large number of children unvaccinated in the district, though visits had been paid to all, and to some three or four times. The latter he had ceased to call upon. Mr. James, of Aberayron, with most careful visiting of his district, could not get many of the children vaccinated till they were three, four, or five years old. And Mr Williams, of Criccieth, had a list of children on whom he had called once and again without being able to vaccinate them, while the parents of many others had consented *to oblige him.* The absence of public plan and of any manifestation of public interest in vaccination had destroyed in people's minds any notion of a legal obligation.

4. Viewed on the whole, it was beyond all doubt that the plan had acted most injuriously on the amount of infantile vaccination. By the enormous amount of dry-lymph vaccination to which it had given rise, it had produced injurious effects on the quality of vaccination, to which I have already referred (*see* section II.)

5. It had also operated in another way, which could not fail to have been detrimental to the quality of vaccination in the extent to which, under it, pupils, apprentices, and other unqualified substitutes had been employed in vaccination. The vaccination and the inspection of some districts had been left almost entirely to them.

These considerations I had ample opportunities of discussing with vaccinators. In towns it was admitted to be a bad and unjustifiable system, only resorted to because the people failed to attend the station, and the guardians failed to compel them.* In rural districts it was generally said by contractors that they had not given up their stational

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* In small and middle-sized towns the plan was found extensively prevalent. In no class of districts were the results more unsatisfactory: or the evils above adverted to more conspicuous.

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attendance, as originally laid down, until they had followed it for successive months without result; that the plan abandoned was for the most part wholly impracticable; and that they would be glad to follow out, instead of their present imperfect arrangements, any plan which might be laid down of a practical character, and which should ensure the attendance of the people also, so that their time might not be spent in vain.

3. *Notifications.*—(*a*) The requirements of the statute that guardians should from time to time take the most effectual means of notifying to all persons resident the times of attendance for public vaccination had been disregarded for many years in some unions; in others was only observed at irregular and distant intervals, or under some special circumstances, *e.g.*, at periods when small-pox was present. I must except two unions, Llandovery and Llanelly, in both which a regular rota of attendances (which were punctually observed by the vaccinators) was made at the commencement of each year and duly published. Under the disregard of contract arrangements which obtained, the notifications of guardians would in most unions have been misleading; but the notices were omitted in places in which contract arrangements were observed, and in which their issue would have been important. Parents of children resident but not born in Chatham or Maidstone, for instance, had no authorized information with regard to the times or the places at which they could obtain public vaccination: vaccinators had been changed and stations had been changed without this being notified to the public. (*b*) The information with regard to times and places of attendance which registrars are required by law to deliver to parents, along with the notice requiring vaccination, was in conformity with the contract arrangements for 115 vaccinating districts or parts of districts; but, with regard to 86 of these, it was entirely incorrect and misleading;* with regard to 10 it was partly misleading; for 19 districts only was it in accordance with the actual vaccinating arrangements. For 30 districts or parts of districts arrangements were notified not in accordance with the schedules. And for 38 districts or parts of districts, in which the notice requiring vaccination was given, no arrangements were notified. The registrars of 11 districts had even omitted to deliver the notice requiring vaccination: viz., Farningham in Dartford Union, Bromley in Bromley Union, Brenchley (occasionally) in Tonbridge Union, Amlwch, and Llandyfrydog in the Anglesea Union, Talylynn in the Dolgelly Union, Llansaintffraid in Llanfyllin Union, Knighton and Llanbister in Knighton Union, Rouse in Pembroke Union, Begelley in Narberth Union (as regarded part of his district).

4. *Performance of other Contract and Statutable Duties.*—(*a*) *By Contractors.* The points of particular inquiry were the employment of deputies; the inspection of results of vaccination; the keeping the registers; the delivery of certificates of successful vaccination to the registrars. 1. *Deputies.*—The regulation requiring that the duties of public vaccinator should be performed in person, or by a duly qualified substitute who had been admitted to act as deputy by the Board, was extensively disregarded. Twenty-five vaccinators had the assistance of qualified

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* People were in many instances misled by them; though in most districts in which the arrangements were disregarded by the contractor they had got by this time to understand that any attendance on their part would be useless. "What's the "use of your putting that? It's a lie," was the not unnatural observation of a parent to a registrar, who was filling in the times and places of the contractor's attendance on the legal notice.

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deputies, but in no instance had these been formally admitted by the board. In the union of Wrexham, and 32 districts of other unions, pupils, apprentices, and unqualified assistants had been employed more or less ; in some to so great an extent as to have called for the interference of guardians. 2. *Inspection.*—I had every reason to be quite satisfied that by the large majority of vaccinators the success of vaccination was always properly ascertained before the case was reported. Several vaccinators who used the help of assistants in vaccinating assured me of their personal attention being invariably given to this point. On the other hand abundant evidence was given me in several unions of cases reported successful, in which there had been no inspection of results whatever, and of cases so reported in which the result had been proved, on investigation, to be otherwise. And there was a feeling on the part of guardians in unions in which the matter had not undergone particular investigation that, especially at times when there was much re-vaccination, the results had not been fairly recorded. I must confess my own inability to reconcile with an accurate inspection of results, the success of re-vaccination as recorded by several vaccinators. 3. *Registers.*—The registers, which it is a stipulation of the contract that vaccinators should keep, had in some districts been omitted altogether ;* in some they had been kept irregularly, the entries being made at long intervals, or no dates put, or the ages not specified ; but in most they were regularly made up from time to time as an account with the guardians. But it was only in a few cases that they were kept as registers, the names of children vaccinated being entered, as is directed, on the day of vaccination, and the results as ascertained on the day of inspection being duly recorded. By five contractors only were re-vaccinations, when they were performed, duly distinguished ; and by one only had the source of lymph used in vaccinating been systematically noted. Vaccinators uniformly expressed their readiness to keep their books in any way that might be desired, but they not unreasonably said that the book ought to be prepared in a form which called their attention to the points requiring to be noted. 4. *Certificates to the Registrars* had in many of the districts been given most irregularly. Boards of guardians had in some instances interfered, and by refusing to pay vaccination accounts until all statutable duties had been fulfilled, had secured a punctual fulfilment of duty by contractors in this respect.

(*b*) *By Registrars.*—In addition to those registrars whom I have already noted as not having given the notice of requirements to parents, I found that 10 others had neglected their register of successful vaccinations ; that 9 more had their books from 6 to 12 months in arrear ; and that 9 had misunderstood the book and so kept it incorrectly. With these exceptions, the registers were perfectly kept ; any deficiency in the entry of certificates being due not to the registrars but to the medical men who should have supplied them ; and they represented to me very strongly the pecuniary loss they suffered by this negligence, diminishing almost to one-half the very insufficient remuneration accorded them by the statute. I can only repeat what I have said in former reports of the great value of the services rendered by the registrars as a body to the furtherance of vaccination, and of the very

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* In some of these districts no certificates of successful vaccination had been sent to the registrar, so that there was no public record whatever of the vaccination which had been performed at the public cost.

inadequate amount of their remuneration, even if they received the full sum to which they are legally entitled. In several districts included in this year's inspections, the effect of their personal exertions and ready assistance to the vaccinators, in addition to the strict performance of their prescribed duties, had been very marked.

IV.—RECOMMENDATIONS.

The recommendations which were given by me in the respective unions to guardians and to those employed in carrying out the vaccination laws, had reference, 1st, to alterations requisite in the existing arrangements for the performance of public vaccination, or the practice of contractors, &c.; and, 2ndly, to the establishment of systematic supervision of public vaccination by the local authority.

1. With regard to the first point, I may state generally that the recommendations given in each place had the aim, which I have kept in view throughout all these inspections, of substituting a real for a fictitious system of public vaccination, and of providing for the vaccination of children direct from the arm to the utmost practicable extent, and under the best attainable conditions. And by the course which generally I was able to suggest, I was satisfied that, under proper supervision, these results might be secured. But in many districts I found it impossible to get rid of conditions of contracts, which were practically useless, and would not I was sure be truly observed, under the ruling of the Poor Law Board which requires that in every vaccinating district there should be at least one station, at which attendance should be given for vaccination at intervals not exceeding one month. The only way in which, in this state of the law, contract arrangements could be made which would in effect be binding would be by a general reconstruction of districts.

2. The supervision recommended to local authorities was of course a supervision as much of the fulfilment of contracts and statutable duties by contractors, as of the obligations of the law by parents. In carrying out this supervision I recommended boards of guardians to have before them, at certain fixed periods, never less than twice a year, the vaccinators' registers, with an abstract of the vaccinations performed in each parish, &c., and when on examination deficiency was seen, to inquire into the cause of neglect, and where this was found to arise from neglect of parents, to take proceedings for the sake of example. I generally recommended them to appoint at once, under 24 & 25 Vict. c. 59., an officer who should institute and conduct proceedings.

The chairmen of several boards, in expressing to me their wish to see effect given to these suggestions, and their intention, as far as possible, to carry them out, represented to me that there were defects in the law which they thought would make any supervision they might be able to exercise still incomplete. First, they did not conceive that the work of seeing that all children born in the union were duly vaccinated would be properly carried out, unless it were made the business of some special officer, and they had no power either to appoint or pay such an officer. Secondly, they had no legal control over, nor legal right of access to, "the register of successful vaccinations," from which to ascertain what children were and were not vaccinated. Thirdly, the information afforded by these registers was necessarily incomplete, because as a rule returns of successful vaccination were not made by private medical practitioners. They conceived that the legislature should take steps to make the registers effectual for the purpose for which they were intended, and they said that as guardians were charged with the duties and responsibilities of the Act, they ought to be entrusted with all powers necessary for carrying them fully into effect.

The chairman of a board of guardians (Sunderland) which I have visited, on account of an epidemic of small-pox, since the inspections now reported on, brought these difficulties to my notice at a meeting of the board, with a request that I would take a suitable opportunity of bringing them specially under the consideration of their Lordships. There can be no occasion more proper than the present one.

APPENDIX.

I. Local inquiries as to Vaccination.

1. Parts of Kent, Hereford, and Wales, by Dr. Seaton.

2.—DR. STEVENS'S SUMMARY of the RESULTS of his INQUIRY in certain UNIONS of CAMBRIDGESHIRE, DERBYSHIRE, HUNTINGDONSHIRE, LEICESTERSHIRE, LINCOLNSHIRE, RUTLANDSHIRE, NORTHAMPTONSHIRE, WARWICKSHIRE, WORCESTERSHIRE, and NOTTINGHAMSHIRE.

2. Parts of Cambridgeshire, Derbyshire, &c., by Dr. Stevens.

THE unions inspected were 93, viz. :—all the nine unions in Cambridgeshire, eight of the nine unions in Derbyshire, all the 30 unions in Huntingdonshire, Leicestershire, Lincolnshire, and Rutlandshire, six of the unions in Northamptonshire, six of the unions in Warwickshire, all the 13 unions in Worcestershire, and all the nine unions in Nottinghamshire.

In the course of the inquiry, and with a view to arrive at an accurate estimate of the quantity and quality of the public vaccination in the localities visited, I have had interviews with the clerks to the guardians, or their representatives, in all the unions inspected. I have conferred with 373 public vaccinators, 235 sub-district registrars, and with the majority of the ministers of religion, and with many other people of influence living in the different districts. I have personally examined the condition, as to vaccination, of 46,871 children in the national parochial workhouse and other public schools, and of a great many in and about the dwellings of the poor and neglected.

As I have had the honour to lay before you a separate report on each union, I propose here to state generally and as succinctly as possible, the result of my inquiry into (1) the quantity of the vaccination, (2) the quality of the vaccination, and (3) the causes of such defect as was observed in either of these respects. Under the last head I shall consider the nature of the arrangements for the performance of vaccination, both as laid down by guardians and as generally adopted by the public vaccinators. I will then pass in review the duties of all those concerned in carrying on the machinery of the different Vaccination Acts, pointing out where these have been neglected, and how far the efficiency of the vaccination has been affected thereby.

1. QUANTITY OF THE VACCINATION.

The following table gives the names of the unions inspected, the number of districts, and of public vaccinators in each, the number of infants vaccinated per 100 of the registered births for three years ended 30th September 1861 ; the number of older vaccinations done in the same period per 100 of the total number vaccinated ; and the number found unvaccinated at the public schools, &c., per 100 of the children examined.

APPENDIX.

I. Local inquiries as to Vaccination.

2. Parts of Cambridgeshire, Derbyshire, &c., by Dr. Stevens.

TABLE A.

Table showing the Number of Cases of Infant Vaccination per 100 of Registered Births for Three Years ended 30th September 1861; also the Proportion of older Vaccinations, calculated on the gross Number vaccinated, and the Per-centage found unvaccinated in the Public Schools visited.

Union.	Number of Districts.	Number of Public Vaccinators.	Infants Vaccinated.	Infants Vaccinated per 100 of Registered Births.	Older Vaccinations, per 100 of Children Vaccinated.	Found Unvaccinated in Public Schools, per 100 of Children examined.
Cambridge - -	4	4	523	23·2	52·8	14·6
Caxton and Arrington	5	5	846	64·0	15·8	10·2
Chesterton - -	6	6	1,438	56·2	17·9	15·5
Ely - - - -	6	7	456	19·7	62·8	13·5
Linton - - -	3	3	738	53·3	24·3	17·8
Newmarket - -	9	10	1,145	40·9	66·0	10·6
North Witchford -	5	5	1,060	65·0	—	—
Whittlesea - -	2	2	310	39·7	30·8	9·9
Wisbeach - -	10	8	1,660	48·6	57·2	13·6
Ashbourne - -	7	7	342	18·9	53·8	19·8
Bakewell - - -	8	8	1,069	36·8	30·9	8·7
Belper - - -	8	8	2,952	52·6	33·5	17·1
Chapel-le-Frith - -	3	3	601	45·1	26·7	12·1
Derby - - -	1	1	2,106	37·1	12·2	16·1
Glossop - - -	2	2	1,550	72·3	6·3	12·4
Hayfield - - -	1	1	555	50·7	14·6	12·4
Shardlow - - -	8	8	1,579	52·7	16·2	9·6
Huntingdon - -	5	5	1,364	64·1	18·6	8·9
St. Ives - - -	5	5	1,357	68·2	24·5	7·9
St. Neots - - -	6	6	908	49·1	34·3	22·7
Ashby-de-la-Zouch -	6	5	1,270	40·0	27·5	17·9
Barrow-on-Soar -	5	5	982	50·5	33·5	13·2
Billesdon - - -	3	3	240	38·4	25·0	16·1
Blaby - - -	3	3	436	28·2	34·5	8·6
Hinckley - - -	5	4	1,063	57·6	16·4	7·8
Leicester - - -	5	6	3,341	44·2	16·8	14·1
Loughborough - -	4	4	1,245	51·1	22·4	13·1
Lutterworth - -	5	5	703	55·3	40·7	20·8
Market Bosworth -	5	5	861	66·7	21·6	17·7
Market Harborough* -	—	6	650	41·0	30·2	19·0
Melton Mowbray -	5	5	936	47·0	66·9	11·1
Boston - - -	8	8	1,658	46·0	47·5	13·9
Bourn - - -	7	12	1,364	63·0	—	15·3
Caistor - - -	9	9	1,928	57·2	29·0	13·3
Gainsborough - -	8	8	1,417	58·6	26·4	10·4
Glandford Brigg -	9	10	2,263	65·3	14·7	11·8
Grantham - -	9	13	2,151	73·7	57·9	12·3
Holbeach - - -	6	6	809	43·1	52·8	9·6
Horncastle - -	6	6	1,389	55·9	29·0	17·5
Lincoln - - -	11	11	3,310	68·5	10·3	14·8
Louth - - -	10	9	1,652	46·5	31·3	13·8
Sleaford - - -	7	7	1,515	58·2	25·5	10·3
Spalding - - -	7	9	887	44·7	67·2	14·7
Spilsby - - -	7	7	1,030	35·5	50·2	17·4
Stamford - - -	6	5	735	42·2	—	14·7
Brackley - - -	4	4	742	51·2	25·2	21·3
Daventry - - -	7	8	820	39·7	48·6	16·4
Kettering - - -	4	4	1,097	53·7	33·0	16·8
Oundle - - -	4	4	1,057	67·4	50·7	6·9
Peterborough - -	9	9	2,117	58·1	32·8	12·2

* Not divided into districts for vaccination.

APPENDIX.

I. Local inquiries as to Vaccination.

2. Parts of Cambridgeshire, Derbyshire, &c., by Dr. Stevens.

Table A.—*continued.*

Union.	Number of Districts.	Number of Public Vaccinators.	Infants Vaccinated.	Infants Vaccinated, per 100 of Registered Births.	Older Vaccinations, per 100 of Children Vaccinated.	Found Unvaccinated in Public Schools, per 100 of Children examined.
Wellingborough -	4	4	1,045	39·3	62·7	22·0
Basford - - -	12	12	5,678	63·7	22·3	14·3
Bingham - - -	4	4	854	55·7	37·0	16·3
E. Retford - -	7	7	1,685	74·5	11·2	10·4
Mansfield - - -	5	5	2,009	60·9	19·6	10·0
Newark - - -	9	9	1,636	52·4	36·3	12·5
Nottingham - -	2	2	4,099	49·7	10·0	16·7
Radford - - -	2	2	2,688	72·6	7·2	10·1
Southwell - - -	7	7	1,396	63·8	19·0	8·6
Worksop - - -	6	6	1,032	53·8	15·9	12·5
Oakham - - -	3	3	732	66·7	29·3	10·2
Uppingham - -	5	5	482	42·2	28·3	15·3
Atherstone - -	2	2	566	44·4	18·9	12·9
Nuneaton - - -	3	3	737	51·8	13·1	9·6
Rugby - - -	9	9	1,341	58·8	31·9	21·9
Solihull - - -	4	4	652	54·2	8·0	—
Southam - - -	4	4	498	47·8	28·1	16·6
Warwick - - -	3	3	1,125	29·6	33·0	20·9
Bromsgrove - -	5	9	1,464	53·2	22·8	9·5
Droitwich - -	6	6	900	46·2	29·9	10·3
Dudley - - -	18	20	10,887	59·3	7·1	15·3
Evesham - - -	5	5	276	19·9	59·1	23·4
Kidderminster - -	6	6	1,649	53·5	27·2	15·8
Kings Norton - -	9	10	2,022	48·1	20·3	11·7
Martley - - -	5	5	636	47·8	40·0	3·5
Pershore - - -	5	5	715	56·3	16·4	15·6
Shipston-on-Stour -	6	6	785	30·1	53·5	24·1
Stourbridge - -	4	15	5,595	64·4	12·9	13·0
Tenbury - - -	2	2	291	44·9	30·0	—
Upton-on-Severn -	5	5	782	44·1	39·8	14·9
Worcester - -	3	3	1,401	47·2	23·0	11·4

It is almost impossible to arrive at a fairly accurate conclusion as to the proportion of the population vaccinated by the consideration of such a table as the foregoing, based as it is upon the annual returns made to the Poor Law Board by clerks to guardians. These returns are liable to many sources of error. They are made up from the registers, so called, of the public vaccinators, and of course these do not make mention of any vaccinations that may have been performed by private practitioners, who in some districts vaccinate to a large amount. Again, conclusions approaching to accuracy can only be deduced from the figures relating to infant vaccination, those under one year of age, as the older vaccinations are often those of adults or of children of considerable age, and in some instances embrace re-vaccination. Therefore the supposition is erroneous, that the short coming of the earlier vaccinations is supplemented by the older vaccinations; for instance, in Spalding union the infant vaccinations appear to be only 44·7 per cent. of the registered births, and the older vaccinations show a per-centage of the gross number of vaccinations (67·2), which would go far to satisfy an inquirer that the vaccination in that union was tolerably, if not quite complete. Whereas the examination of children at the public schools discovered 14·7 per cent. of those examined to be unvaccinated. The above table will afford many similar instances, as Newmarket, where the infant vaccinations amounted to 40·9 per cent. of the registered births, the older vaccinations were 66·00 per cent. of the total vaccinations, and yet upwards of 10 per cent. of the children examined were found unvaccinated. In Melton Mowbray the same point is illustrated. Grantham, the union which stands second as regards amount of infant vaccination, figures at 73·7 per cent., but in this union the older vaccinations amount to 57·9 per cent., and in opposition to any favourable conclusion which might be drawn of this apparently almost perfect return, 12·3 per cent. of the school children were found unvaccinated. These apparent anomalies are to be accounted for by the fact that in some unions re-vaccinations have been performed to a considerable extent without being distinguished as such in the registers, as in Spalding, Grantham, Shipston-on-Stour, &c., or, as in Newmarket, Melton Mowbray, &c., that the majority of the vaccinations are those of children who have been neglected for many years, and who have been carefully looked up by the activity of some recently appointed public vaccinator.

In some few districts the high numbers representing the older vaccinations may be considered as tending to a large extent to make up the deficiency in the infant columns. These instances occur in localities far from the vaccinator's residence and which are visited at very distant intervals, perhaps once a year only, or they may be occasionally found as the result of the belief on the part of the contractors that the age at which children are to be vaccinated as laid down by the Compulsory Act is too young, which has induced them to delay these vaccinations.

The examination of the registers of successful vaccinations kept by the registrars shows as a general rule, where the registrar is particular and takes an interest in the duty, that where the certified infant vaccinations in a union amount to over 70·0 per cent. of the registered births there can be but little neglect. The children who die before they can be vaccinated, together with those who are operated on by private medical practitioners, who make no return to registrars, amount in a large number of unions to 25 per cent. of the registered births.

This large per-centage of uncertified vaccinations is made up of very different proportions of its two elements in different, even closely contiguous, unions. In the large towns, as Lincoln, Leicester, Nottingham, Derby, &c. both causes are prominently rife ; infant mortality, and the interference of non-certifying vaccinators both tend very materially in such places to keep down the apparent rate of public vaccination. In unions closely adjacent to large towns, as Billesdon, Blaby, King's Norton, &c. a low rate of vaccination appears to prevail, owing in great measure to the interference of numerous medical practitioners living in the neighbouring towns ; the premature infant mortality being generally lower has much less to do with the unfavourable returns. Then in many unions far remote from towns, and especially in some districts in the Fens in which the vaccination is entirely in the hands of the public vaccinator, the infant mortality often is so high as alone, without the other element of error, to cause the public returns to show a very low rate of infant vaccination, as Spilsby, Holbeach, Ashbourne, Whittlesea, Shipston-on-Stour, &c., &c. ; the rates of infant vaccination being calculated on the number of births registered, and in these unions that number being so materially reduced by premature deaths.*

On the other hand the experience derivable from the examination of children at the public schools is not so valuable a means of estimating the current or recent amount of public vaccination in the district as it

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* The public vaccinator for the Spilsby East District of the Spilsby Union stated that in some of the villages in the Fens *one-half* the infants died before they were twelve months old.

might appear, though every child found unprotected is with few exceptions direct evidence of the neglect of former years.

It must, therefore, be conceded that the conclusions to be drawn from the Table A. are much more unfavourable than at the first glance they would appear. The older vaccinations must not be considered to go very far towards repairing the deficiency apparent in the amount of infant vaccination and the per-centages of children found unvaccinated. A public institution must be held to represent by no means the whole of the neglect of former years, (as in all probability the most neglected children are not found in schools,) and very little, if any, of that of a very recent period, as the average age of the children examined would be from eight to nine years.

The following Table (B.) gives the per-centage of children found unvaccinated in the infant schools as compared with that in the mixed schools for the older children :—

TABLE B.

In which is made a Comparison between the Vaccination of Infants and of older Children, as to Quantity as well as Quality, based upon the Examinations at Public Schools.

Union.	District.	Well Vaccinated.		Not Vaccinated.	
		Infants.	Older.	Infants.	Older.
Grantham	Grantham	12·2	20·5	9·9	8·2
Boston	Boston	1·2	9·2	20·0	13·6
Lincoln	Lincoln	4·2	12·2	15·3	14·1
Gainsborough	Gainsborough	9·4	16·0	17·9	9·5
Caistor	Grimsby	7·7	6·8	12·6	12·1
Louth	Louth	3·1	12·5	12·5	14·3
Spalding	Spalding	7·8	13·2	15·7	14·3
Melton Mowbray	Melton	16·8	24·7	15·6	10·3
Loughborough	Wymeswold	0·0	5·7	12·1	10·4
Hinckley	Burbage	37·0	22·2	0·0	7·4
Lutterworth	Lutterworth	44·7	28·9	15·7	14·9
Kettering	Kettering	3·2	9·5	29·5	14·4
Oundle	King's Cliff	33·3	27·9	0·0	9·3
Caxton and Arrington	Gamlingay	12·0	41·1	4·0	8·8
Newmarket	Newmarket	77·2	32·2	4·5	14·5
Huntingdon	Huntingdon	52·3	39·3	11·9	11·7
Uppingham	Uppingham	13·1	7·9	18·0	12·3
Rugby	Rugby	1·0	7·1	24·7	15·0
Warwick	Leamington	12·3	17·5	34·5	15·9
Dudley	Rowley	0·0	3·1	21·4	16·7
,,	Tipton	0·0	1·3	32·4	13·9
,,	Sedgley	0·0	3·8	21·6	7·3
Kidderminster	Lower Mitton	8·4	19·3	26·3	9·6
Droitwich	Ombersley	10·6	26·6	4·2	6·6
Bromsgrove	Redditch	5·4	5·2	24·3	10·7
Worcester	Worcester	33·6	32·3	12·5	9·6
Pershore	Pershore	4·5	14·7	7·5	10·2
Evesham	Hampton	15·7	28·2	45·6	22·8
Derby	Derby	1·4	8·9	22·3	14·6
Shardlow	Shardlow	5·4	14·2	41·8	14·2
,,	Breadsall	0·0	32·3	20·0	1·4
Ashbourne	Mayfield	6·5	21·2	34·7	14·8
Glossop	Glossop	7·2	4·0	16·8	15·3
Bakewell	Bakewell	20·0	46·5	12·0	4·6
,,	Matlock	11·1	20·2	11·1	10·1
Belper	Wirksworth	19·7	15·3	13·5	10·2
Bingham	Cotgrave	16·9	6·6	22·0	13·3
Retford	Tuxford	37·9	29·0	10·3	3·2
Worksop	Worksop	4·0	7·3	13·3	17·9

APPENDIX.

Local inquiries as to Vaccination.

2. Parts of Cambridgeshire, Derbyshire, &c., by Dr. Stevens.

It would not be desirable in this table to give a comparative list of all the schools (in number upwards of 600) inspected in the districts visited, as it would extend this report very considerably and unnecessarily. The examples given are of districts in which the greatest discrepancy was found, and they will suffice to show how varying is the value and applicability, as a means of forming a just estimate of the present state of public vaccination, of the bare results of school examination unless those results be carefully weighed and analyzed.

Where the chief neglect appears in the older children, and where the public returns show a fairly high rate of infant vaccination, the report would be more favourable than where fewer children were found unvaccinated with even a slightly higher rate of infant vaccination in the public returns, provided that the unprotected children were found in the infant schools or in the baby classes of the older schools.

With the above proposition Table A. may be read with a fair presumption that an accurate estimate may be drawn from it of the condition of public vaccination in the different unions at the present time. And the following analysis of the unions will afford facilities for arriving at such conclusions with tolerable justness. The unions in the first column are those wherein the amount of vaccination is fair or improving, the second column contains those in which it is below the average and more or less stationary, and in the third will be found those in which it is much neglected or decreasing.

TABLE C.

Showing the Unions in which the Quantity of Infant Vaccination was either—

Increasing.	Stationary.		Diminishing.
Linton.	Cambridge.	Mansfield.	Chesterton.
Whittlesea.	Caxton and Arrington.	Radford.	Wisbeach.
Bakewell.	Ashbourne.	Stourbridge.	Belper.
Billesdon.	Huntingdon.	Upton-on-Severn.	Glossop.
Oundle.	Spilsby.	Ely.	Hayfield.
Peterborough.	Daventry.	North Wichford.	St. Ives.
Southwell.	Warwick.	Chapel-le-Frith.	Barrow-on-Soar.
Uppingham.	Devitwich.	Shardlow.	Hinckley.
Bromsgrove.	King's Norton.	St. Neots.	Lutterworth.
Tenbury.	Worcester.	Ashby - de - la - Zouch.	Market Harborough.
	Bingham.	Blaby.	Melton Mowbray.
	Newark.	Leicester.	Boston.
	Newmarket.	Market Bosworth.	Bourn.
	Derby.	Caistor.	Glandford Brigg.
	Longborough.	Grantham.	Holbeach.
	Gainsborough.	Sleaford.	Lincoln.
	Horncastle.	Atherstone.	Spalding.
	Louth.	Nuneaton.	Brackley.
	Stamford.	Evesham.	Basford.
	Kettering.	Kidderminster.	Worksop.
	Wellingborough.	Martley.	Oakham.
	East Retford.	Nottingham.	Rugby.
			Solihull.
			Southam.
			Pershore.
			Shipston-on-Stour.

In forming the above table I have availed myself, in some instances, of other information in my possession, which had a tendency to qualify the results obtained from the materials of the two preceding tables.

APPENDIX.

I. Local inquiries as to Vaccination.

2. Parts of Cambridgeshire, Derbyshire, &c., by Dr. Stevens.

For instance, when I have been aware that a large amount of vaccination was done by private practitioners, I have been guided by the evidence given me by the registrars to this effect. In other unions the neglect had been almost entirely confined to one district, perhaps, for many years, and the fact that this district had been well looked after of late forbade a too exclusive reliance upon figures. Again, the excessive infant mortality in some of the unions, more especially in the fenny districts of Lincolnshire and Cambridgeshire, justified the belief, which experience proved, that the low returns shown by many of these were deserving of a much higher estimate.

To give an approximative return of the amount of vaccination done in the different districts of the unions inspected would be a very difficult task, and the results would prove too bulky and unwieldy for the purposes of this report ; I have, therefore, in the table (E.) which sets forth the quality of the vaccination in every district visited, added a column containing the number of infants vaccinated per 100 of the registered births in the districts in which I had materials for that calculation.

In some districts the neglect of vaccination was so great that I have thought it necessary to place before you some details respecting them in the following tabular form, table (D.).

TABLE D.

Giving Particulars of certain much-neglected Districts.

Unions.	Districts.	Population.	Infant Vaccinations per 100 of Population for 3 Years ended 30th September 1861.	Remarks.
Ely - - -	Littleport - -	3,832	1·6	None during 1861.
Wisbech - -	Upwell and Outwell Isle.	1,814	2·5	„ „
Ashbourne - -	Ashbourne - -	5,490	0·2	None during 1859.
Bakewell - -	Winston - -	4,522	0·6	None during 1859 and 1860.
Belper - -	Alfreton - -	7,315	1·0	
Huntingdon - -	Godmanchester -	4,362	1·9	
St. Neots - -	Kimbolton - -	2,838	0·5	None in 1859 and only one in 1860.
Billesdon - -	Western, No. 1 -	2,198	0·5	
Latterworth - -	Latterworth -	5,011	2·5	
Caistor - -	Tealby - -	1,956	1·7	
Holbeach - -	North Holbeach -	3,763	2·4	None in 1861.
Spilsby - -	Spilsby, East -	4,689	2·0	
Daventry - -	Weedon - -	3,619	2·1	
Wellingborough -	Wellingborough -	9,848	2·0	
„ -	Wollaston - -	3,277	2·2	
East Retford - -	Scrosby - -	385	0·0	None for 3 years.
Newark - -	Broughton - -	1,414	2·1	
Worksop - -	Blyth - -	1,658	1·0	
„ - -	Carlton - -	1,597	0·8	
Uppingham - -	Hallaton - -	1,207	0·1	One case in 1859, one in 1860, and none in 1861.
Solihull - -	Yardley - -	3,851	0·9	
Bromsgrove - -	Bellroughton -	4,220	1·3	None in 1860.
Droitwich - -	Hanbury - -	3,118	0·9	
Evesham - -	Broadway - -	2,997	0·6	
King's Norton -	Northfield - -	3,129	1·4	
Shipston-on-Stour -	Mickleton - -	1,870	0·4	None in 1859, 1861, or 1862.
„ -	Shipston - -	4,460	1·1	

N.B.—The births in the different districts mentioned in the Table occurred at the rate of from 3½ to 4 per 100 of the population in each of the three years.

In this table I have scrupulously omitted large towns or localities in which there was good ground for believing that the vaccination was much more complete than was shown by the public returns, owing to the extensive vaccination of non-certifying practitioners, &c. &c.

APPENDIX.

I. Local inquiries as to Vaccination.

2. Parts of Cambridgeshire, Derbyshire, &c., by Dr. Stevens.

While dealing with the quantity of vaccination I must mention that in some few places this appeared to be far greater than the known birth rate would justify. Thus, in the Cradley and Halesowen districts of the Stourbridge union, the rate of infant vaccination for the three years ended 30 September 1861 had been 103·9 per cent. of the registered births, and it was increasing year by year, so that in the last year of the series it had attained to 119·5 per cent. This had been caused by the insertion in the medical registers for those districts of numerous vaccinations which had been done by the contractors in parishes beyond the limits of the Stourbridge union. Those vaccinations had been very improperly entered as belonging to parishes in the union. In the Skellingthorpe district of the Lincoln union the infant vaccinations for the year ended 30th September 1861 amounted to 500·0 per cent., and in the Nettleham district of the same union to 165·0 per cent. of the registered births.

These two districts were held by two contractors, who were in partnership. They resided in Lincoln, and vaccinated extensively in the Lincoln district, returning the vaccinations as belonging to the districts for which they contracted ; a practice which caused great confusion in the vaccination returns, and considerable annoyance to, and tending to neglect of duty on the part of, the contractor for the last named district, which was so poached upon. These two instances are fair examples of the causes of such apparently high rates of vaccination as were not unfrequently met with in the course of my inquiry.

WORKHOUSES.

The examination of children in the workhouses of the several unions discovered a large neglect of vaccination. This appears to be referrible to two principal causes ; 1st, the constant change of population in these institutions, and, 2nd, the practice by some boards of guardians of including the payment for workhouse vaccination in the salary paid for general medical attendance. In the following table (DD.), the number of children examined, the quality of their vaccination, the number protected by small-pox, and the proportion found unvaccinated, are given. The workhouses of unions in which payment for vaccination is not made per case are indicated by an *.

TABLE D.D.

Workhouses.

Union.	Number of Children Examined.	Per Cent. Well Vaccinated.	Per Cent. Indifferently Vaccinated.	Per Cent. Badly Vaccinated.	Per Cent. marked by Small Pox.	Per Cent. Un-vaccinated.
Cambridge - - -	55	20·0	69·0	0·0	1·8	10·9
Caxton and Arrington -	35	14·2	71·4	8·5	0·0	5·7
Ely - - - -	48	10·4	56·2	8·3	2·0	25·0
Linton - - -	52	19·2	69·2	7·6	0·0	3·8
Newmarket - - -	64	34·3	48·4	6·2	0·0	10·9
North Witchford - -	32	25·0	65·6	6·2	3·1	3·1
Whittlesea - - -	12	33·3	66·6	0·0	0·0	0·0
Wisbeach - - -	125	11·2	57·6	18·4	1·6	12·8
Ashbourne - - -	43	2·3	48·8	16·2	4·6	32·5
Bakewell - - -	38	10·5	63·1	18·4	0·0	7·8
Belper - - - -	96	5·2	69·7	8·3	2·0	16·6
Derby - - - -	49	4·0	63·2	8·1	6·1	24·4
Glossop - - -	27	7·4	70·3	11·1	0·0	11·1
Hayfield - - -	9	11·1	66·6	11·1	0·0	11·1
Shardlow - - -	68	11·7	60·2	10·2	0·0	17·6

Table D.D.—*continued.*

Union.	Number of Children Examined.	Per Cent. Well Vaccinated.	Per Cent. Indifferently Vaccinated.	Per Cent. Badly Vaccinated.	Per Cent. marked by Small-pox.	Per Cent. Unvaccinated.
Huntingdon	52	32·6	50·0	5·7	1·9	11·5
St. Ives	41	51·2	36·5	4·8	2·4	7·3
St. Neots	28	39·2	53·5	7·1	0·0	0·0
Ashby-de-la-Zouch	83	4·8	50·6	14·4	1·2	30·1
Hinckley	36	33·3	41·6	5·5	0·0	19·4
Leicester*	147	28·5	29·2	14·3	1·2	27·9
Loughborough	51	9·8	62·7	5·8	11·7	21·5
Lutterworth	50	10·0	68·0	12·0	0·0	10·0
Market Bosworth	43	27·9	37·2	6·9	0·0	27·9
Market Harborough	41	29·2	48·7	4·8	0·0	17·0
Melton Mowbray	78	26·9	44·8	16·6	0·0	11·5
Boston	117	5·1	49·5	23·9	1·7	21·3
Bourn	43	25·5	41·8	13·9	0·0	18·6
Caistor	77	10·4	72·7	10·4	0·0	6·4
Gainsborough	73	13·6	50·6	19·1	2·7	16·4
Glandford Brigg	58	12·0	50·0	27·5	0·0	10·3
Grantham	50	14·0	46·0	32·0	0·0	8·0
Holbeach	91	18·6	41·7	25·2	0·0	14·2
Horncastle	79	11·3	58·2	13·9	0·0	16·4
Lincoln	131	25·9	40·4	20·6	1·5	12·9
Louth	99	5·0	59·5	19·1	0·0	16·1
Sleaford	67	22·3	53·7	11·9	0·0	11·9
Spalding	92	8·6	63·0	17·3	0·0	10·8
Spilsby	62	14·5	54·8	12·9	1·6	17·7
Stamford	72	23·6	45·8	19·4	1·3	11·1
Brackley	57	17·5	47·3	10·5	0·0	24·5
Daventry	53	7·5	49·0	9·4	9·4	33·9
Kettering	27	14·8	40·7	18·5	0·0	25·9
Oundle	62	41·9	43·5	6·4	0·0	8·0
Peterborough	93	19·3	63·4	3·3	0·0	11·8
Wellingborough	51	21·5	39·2	17·6	3·9	21·5
Basford*	86	6·9	54·6	10·4	3·4	27·9
Bingham	22	13·6	68·1	13·6	0·0	4·5
East Retford	30	0·0	66·6	13·3	0·0	20·0
Mansfield	55	5·4	78·1	10·9	0·0	5·4
Newark	62	20·9	50·0	16·1	0·0	12·9
Nottingham*	232	12·5	58·6	16·8	1·7	12·0
Radford	34	2·9	67·6	26·4	2·9	2·9
Southwell	44	6·8	72·7	2·2	0·0	18·1
Worksop	58	6·8	55·1	10·3	0·0	27·5
Oakham	14	64·2	14·2	21·4	0·0	0·0
Uppingham	38	15·7	47·3	15·7	0·0	21·0
Atherstone	19	5·2	52·6	10·5	0·0	31·5
Nuneaton	36	38·8	33·3	2·7	0·0	25·0
Rugby	27	14·8	62·9	0·0	3·7	22·2
Solihull	13	0·0	69·2	15·3	0·0	15·3
Southam	33	3·0	60·7	27·2	0·0	9·0
Warwick	87	8·0	55·1	34·4	0·0	2·2
Bromsgrove	43	13·9	58·1	13·9	6·9	13·9
Droitwich	32	6·2	75·0	3·1	0·0	15·6
Dudley	121	3·3	68·5	19·0	7·4	9·0
Evesham	46	36·9	36·9	10·8	0·0	15·2
Kidderminster	64	21·8	56·2	15·6	0·0	6·2
King's Norton	33	27·2	57·5	3·0	0·0	12·1
Martley	29	20·6	68·9	0·0	0·0	10·3
Shipstone-on-Stour	52	25·0	42·3	15·3	0·0	17·3
Stourbridge	119	6·7	58·8	8·4	10·0	26·0
Tenbury	10	40·0	50·0	10·0	0·0	0·0
Worcester	68	39·7	39·7	10·2	4·4	10·2

I. Local inquiries as to Vaccination.

2. Parts of Cambridgeshire, Derbyshire, &c., by Dr. Stevens.

The quality of the vaccination in a workhouse cannot be taken as a fair indication of the practice of the contractor who has medical charge of the inmates, or of that of the public vaccinator of the vaccination district in which the house happens to be situated, therefore one table embodies both quantity and quality of workhouse vaccination. The latter will not be further alluded to, as the children are necessarily received from several districts and often from places remote from the union.

2. QUALITY OF THE VACCINATION.

The information derived as to the quality of the vaccination in the large area visited is much more satisfactory on the score of its completeness and freedom from possibility of error than is that attainable when inquiring into the amount of vaccination done. As to its results, however, there can be no satisfaction, for they lay patent the fact that but a very small proportion of the supposed-to-be-vaccinated population has received such protection from death by small-pox as efficient vaccination is known to give.

I have carefully tabulated the results of my examination of the children at public schools in 231 districts, Table E.

Those children found to have four or three characteristic cicatrices I have esteemed "well vaccinated." Those having two or one similar marks I have accounted "indifferently vaccinated," and those having marks without any of the character of a vaccine cicatrix, merely discoloration of the skin, and sometime hardly that, I have considered badly vaccinated. In drawing these conclusion I have departed somewhat from the course I pursued during my inspection in 1861. I have assessed all marks found on the arms, which were clearly attempts at vaccination, as either "good" or "bad." I have not condemned any but those which were utterly and indubitably bad, giving the utmost possible breadth to my estimate of what constitutes a good or typical cicatrix. Having made this statement and with the understanding that the examinations extended to very few children under 3 years of age, the table may be accepted as giving a very exact representation of the quality of the vaccination in the districts specified.

TABLE E.

Union.	District.	Number of Children examined.	Per Cent. well vaccinated.	Per Cent. indifferently vaccinated.	Per Cent. badly vaccinated.	Per Cent. marked by Small-pox.	Per Cent. unvaccinated	Infants vaccinated per 100 of registered Births from annual Returns.
Cambridge -	St. Giles' - -	217	32·2	43·7	8·7	2·7	15·2	—
,, -	St. Mary the Great	198	19·1	52·0	12·6	2·0	16·1	—
,, -	St. Andrew's the Less.	206	24·2	51·9	10·1	·9	13·5	—
Caxton and Arrington.	Gamlingay - -	160	31·8	55·6	5·6	—	6·8	—
,,	Wimpole - -	49	26·5	63·2	0·0	—	10·2	—
,,	Caxton, 1 - -	42	4·7	92·8	0·0	—	2·3	—
,,	Gransden - -	31	22·5	45·1	9·6	—	22·5	—
Chesterton -	Chesterton - -	86	20·9	54·6	11·6	—	12·7	52·9*
,, -	Waterbeach - -	93	20·4	49·4	8·6	—	21·5	61·8*
,, -	Great Shelford -	129	22·4	50·3	14·7	—	12·4	55·2*
,, -	Fulbourn - -	84	7·1	77·3	1·1	—	14·2	49·3*
,, -	Willingham - -	178	51·1	35·3	6·7	—	6·7	33·2*

* Calculations based on reports for three years ended 30th September 1861.

TABLE E.—*continued.*

Union.	District.	Number of Children examined.	Per Cent. well vaccinated.	Per Cent. indifferently vaccinated.	Per Cent. badly vaccinated.	Per Cent. marked by Small-pox.	Per Cent. unvaccinated.	Infants vaccinated per 100 of registered Births from annual Returns.
Ely	Witchford	52	11·5	53·8	25·0	—	9·6	95·2†
,,	Sutton	131	4·5	58·0	12·2	—	25·1	26·9†
,,	Haddenham	142	48·2	26·0	7·0	—	17·6	46·6†
,,	Trinity	89	34·8	53·9	7·7	—	3·3	2·2†
,,	St. Mary's	182	21·4	57·6	8·7	·5	12·0	7·8†
Linton	Balsham	193	6·2	73·0	6·7	—	13·9	73·1*
,,	Linton	240	16·2	58·3	10·0	—	15·4	66·4*
,,	Duxford	66	6·0	63·6	6·0	—	24·2	23·7*
Newmarket	Newmarket	146	39·0	43·8	4·1	2·0	13·0	60·8†
,,	Burwell	98	14·2	67·3	8·1	—	10·2	40·0†
,,	Fordham	60	23·3	58·3	3·3	—	15·0	54·1†
,,	Cheveley	109	33·0	55 1	6·4	—	4·5	55·3†
Whittlesea	Whittlesea	151	29·8	42·3	17·8	1·3	9·9	—
Wisbeach	Leverington	127	18·1	54·3	19·6	—	7·8	—
,,	Newton	30	3·3	53·3	20·0	—	23·3	—
,,	Wisbeach	471	22·2	48·8	16·3	1·6	12·5	—
,,	Walsoken	54	29·6	50·0	9·2	—	11·1	—
Ashbourne	Parwich	42	11·9	50·0	16·6	—	21·4	17·7†
,,	Brassington	69	26·0	47·8	14·4	—	11·6	25·7†
,,	Mayfield	93	13·9	53·7	7·5	1·0	24·7	63·1†
,,	Calton	81	22·2	59·2	11·1	—	7·4	18·5†
,,	Ashbourne	229	13·1	38·4	14·4	3·0	34·0	4·3†
Bakewell	Bakewell	68	36·7	44·0	11·7	—	7·3	—
,,	Matlock	117	18·8	58·9	11·9	—	10·2	—
Belper	Belper	189	5·2	60·8	10·5	—	23·2	4·7‡
,,	Worksworth	159	17·6	54·0	15·7	—	11·9	3·9‡
,,	Crick	142	15·4	51·4	16·9	2·1	16·2	3·4‡
Chapel-le-Frith	Buxton	293	11·9	60·0	13·3	1·0	14·6	35·1†
,,	Chapel-le-Frith	165	27·2	35·7	25·4	1·8	11·5	41·1†
,,	Castleton	77	3·8	67·5	18·1	—	10·3	54·4†
Derby	Derby	712	7·6	66·1	10·1	1·4	16·1	37·1*
Glossop	Whitfield	203	9·8	65·5	15·2	—	9·3	—
,,	Glossop	687	5·8	66·2	12·3	1·3	15·5	—
Hayfield	Hayfield	225	18·6	57·3	11·5	—	12·4	50·7*
Shardlow	Shardlow	104	9·6	54·8	6·7	4·8	28·8	44·6†
,,	Stapleford	148	29·7	60·8	6·0	—	3·3	35·3†
,,	Kegworth	124	3·2	76·6	11·2	—	8·8	27·0†
,,	Castle Dorrington	104	16·3	70·1	8·6	—	4·8	59·4†
,,	Normanton	33	18·1	69·6	6·0	—	6·0	116·1†
,,	Melbourne	172	9·2	62·1	11·0	—	16·8	36·4†
,,	Breadsall	88	25·0	62·5	6·7	—	5·6	50·0†
,,	Spondon	34	64·7	26·4	5·8	—	2·8	69·4†
Huntingdon	Godmanchester	211	38·8	48·3	4·2	—	8·5	8·2†
,,	Alconbury	37	37·8	43·2	10·8	—	8·1	71·8†
,,	Huntingdon	168	43·4	35·1	11·3	—	10·1	81·3†
,,	Sawtrey	108	38·8	43·5	8·3	—	9·2	70·0†
St. Ives	St. Ives	232	43·5	39·6	6·4	—	10·3	98·1†
,,	Somersham	65	40·0	53·8	3·0	—	3·0	28·8†
,,	Wistow	32	34·3	56·2	6·2	—	3·1	42·1†
,,	Worboys	171	35·0	44·4	12·8	—	7·5	75·0†
,,	Swavesey	88	20·4	56·8	6·8	—	15·9	22·2†
St. Neot's	St. Neot's	340	40·8	41·1	5·8	—	12·0	60·6†
,,	Great Staughton	53	3·7	60·3	3·7	—	32·0	34·3†
,,	Kimbolton	60	13·3	53·3	3·3	—	30·0	15·6†
,,	Eynesbury	148	46·6	31·0	5·4	—	16·8	58·6†
Ashby-de-la-Zouche.	Ashby	344	8·1	54·0	18·3	3·1	19·4	36·3†
,,	Measham	194	4·1	73·1	6·1	1·0	16·4	34·8†
Barrow-on-Sour	Quorndon	103	13·5	67·9	6·7	—	11·6	46·3*
,,	Rothley	167	10·7	70·6	3·5	1·7	14·9	69·4*
Billesdon	Weston	74	45·9	24·2	13·5	—	16·1	6·4*
Blaby	Wigston	120	36·6	30·8	24·1	—	8·3	—
,,	Enderby	110	24·5	44·5	21·8	—	9·0	—
Hinckley	Shilton	82	64·6	21·9	6·0	1·0	7·3	44·6†
,,	Burbage	159	27·1	52·8	10·0	—	10·0	67·7†
,,	Hinckley	212	43·3	41·0	9·4	0·9	6·1	42·9†
Leicester	St. Mary's	843	42·8	32·7	8·4	0·4	16·0	—
,,	St. Margaret's	292	39·7	31·8	16·0	0·6	12·3	—

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* Calculations based on reports for three years ended 30th September 1861.

† Calculations based on reports for one year ended 30th September 1861.

‡ For three years per 100 of the population, the birth rate for the union having been 11·9 per 100 of the population.

I. Local inquiries as to Vaccination.

2. Parts of Cambridgeshire, Derbyshire, &c., by Dr. Stevens.

TABLE E.—*continued.*

Union.	District.	Number of Children examined.	Per Cent. well vaccinated.	Per Cent. indifferently vaccinated.	Per Cent. badly vaccinated.	Per Cent. marked by Small-pox.	Per Cent. unvaccinated.	Infants vaccinated per 100 of registered Births from annual Returns.
Loughborough	Loughborough	781	15·7	58·5	10·8	0·7	14·5	—
,,	Sheepshed	354	31·9	37·2	14·9	1·1	15·8	—
,,	Leaks	120	25·0	57·5	5·8	—	11·6	—
,,	Wyneswold	138	4·3	81·1	3·6	—	10·8	—
Lutterworth	Lutterworth	332	29·8	47·1	4·5	—	18·0	25·5†
,,	Dunton, Bassett	25	16·0	28·0	12·0	—	44·0	60·5†
,,	Broughton	145	6·2	80·0	3·4	10·0	10·3	68·4†
,,	Pailton	16	37·5	31·2	6·1	—	25·0	63·6†
,,	Walford	43	37·2	46·5	9·3	—	6·9	80·8†
Market Bosworth.	Desford	49	4·0	61·3	16·3	—	18·3	54·8†
,,	Markfield	127	5·5	61·4	12·5	—	24·4	63·5†
,,	Twycross	29	6·8	62·0	17·2	—	13·7	70·0†
,,	Bosworth	215	31·1	42·7	11·6	—	14·4	62·7†
Market Harboro'.	Whole Union	289	13·4	55·0	12·4	0·6	19·0	—
Melton Mowbray.	Melton	539	23·5	44·1	21·1	0·7	11·1	—
Boston	Boston	986	6·8	57·2	20·5	0·8	15·3	—
,,	Skirbeck	120	10·8	51·6	25·0	—	12·5	—
Bourne	Bourne	124	12·0	50·0	22·5	—	15·3	—
Caistor	Caistor, 1	137	2·9	61·3	21·8	—	13·8	66·6†
,,	Grimsby	569	7·2	65·3	14·9	2·8	12·4	53·4†
,,	Market Rasen	108	11·1	48·1	24·0	—	15·7	43·4†
Gainsbro'	Gainsbro'	409	14·1	47·1	26·6	1·4	11·9	58·7*
,,	West Butterwick	193	11·3	59·5	18·1	—	10·8	57·4*
,,	Haxey	69	17·3	44·9	28·9	1·4	8·6	50·4*
Glandford Brigg	Brigg	239	4·6	65·2	15·0		15·0	50·0†
,,	Kirton	154	5·8	52·5	27·2	—	14·2	32·8†
,,	Barton	222	12·1	58·5	17·1	—	12·1	57·0†
,,	Ulceby	132	2·2	69·6	21·2	—	6·0	91·1†
Grantham	Spittlegate	94	14·8	42·5	26·5	1·0	15·9	—
,,	Grantham	1,075	17·8	52·8	20·3	·7	8·8	—
Holbeach	Holbeach, North	175	5·7	61·5	14·8	—	18·2	—
,,	Gidney Hill	26	11·5	61·5	19·2	—	7 6	—
,,	Long Sutton	79	26·5	50·6	12·6	—	10·1	—
,,	Lutton	40	32·5	55·0	10·0	—	2·5	—
Horncastle	Horncastle	531	14·5	47·6	20·1	0·01	17.5	25·5†
Lincoln	Lincoln	962	11·0	57·5	17·6	0·9	14·8	—
Louth	Louth	462	9·9	56·7	19·0	0·2	13·8	47·7†
Sleaford	Sleaford	174	24·1	46·5	19·0	—	10·3	37·5†
Spalding	Spalding	254	11·6	53·1	20·6	0·3	14·7	—
Spilsby	Spilsby, East	93	13·8	52·6	13·8	—	19·3	—
,,	,, West	73	9·5	53·4	13·6	1·3	23·2	—
,,	Stickney	41	2·4	63·4	24·3	—	9·7	147·5†
Stamford	Stamford	473	20·9	36·1	28·1	2·3	14·7	36·9†
Brackley	Whitfield	16	25·0	56·2	0·0	—	18·8	—
,,	Brackley	42	26·1	40·4	9·5	—	23·8	—
Daventry	Daventry	276	8·7	64·1	6·8	3·9	20·3	32·8†
,,	Bramston	54	16·6	38·8	20·3	3·7	24·0	40·0†
,,	Long Buckby	201	5·9	71·7	10·9	—	11·4	51·7†
,,	Weedon	40	10·0	67·5	12·5	2·5	10·0	14·7†
Kettering	Kettering, 1	386	8·5	65·0	9·5	0·5	16·8	38·2†
Oundle	Barnwell	41	29·2	63·4	7·3	—	0·0	74·1†
,,	Weldon	115	13·0	66·0	7·8	—	13·0	47·6†
,,	King's Cliffe	154	29·2	51·2	12·4	0·6	7·1	58·9†
,,	Oundle	327	35·1	45·5	9·7	0·9	9·7	89·1†
Peterboro'	Peterboro'	898	12·4	58·5	16·3	1·2	12·2	63·3†
Wellingboro'	Higham Ferrers	25	12·0	48·0	16·0	—	24·0	76·1*
,,	Earls Barton	20	30·0	45·0	5·0	—	20·0	35·6*
Basford	Basford	88	9·0	62·5	11·2	4·5	17·0	40·4†
,,	Kirkley	27	0·0	70·3	25·9	3·7	3·7	51·6†
,,	Bulwell	89	1·1	62·9	12·3	6·7	23·5	30·3†
,,	Greasley	152	3·2	71·7	14·4	1·9	10·5	88·1†
,,	Ilkeston	190	3·1	63·1	16·8	1·5	16·8	59·3†
Bingham	Bingham	106	2·8	78·3	10·3	0·9	8·4	34·3†
,,	East Bridgeford	79	18·9	62·0	12·6	—	6·4	101·3†
,,	Cotgrave	104	12·5	56·7	12·5	—	18·2	24·9†
,,	Hickling	31	3·2	58·0	6·4	—	32·2	83·5†

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* Calculations based on reports for three years ended 30th September 1861.

† Calculations based on reports for one year ended 30th September 1861.

Table E.—*continued.*

Union.	District.	Number of Children examined.	Per Cent. well vaccinated.	Per Cent. indifferently vaccinated.	Per Cent. badly vaccinated.	Per Cent. marked by Small-pox.	Per Cent. unvaccinated.	Infants vaccinated per 100 of registered Births from annual Returns.
East Retford -	Tuxford - -	60	33·3	46·6	13·3	—	6·6	108·6†
,, -	Dunham - -	66	10·6	53·0	13·6	—	22·6	60·0†
,, -	Leverton - -	89	3·3	82·0	10·1	—	4·4	77·9†
,, -	Clarborough -	52	3·8	76·7	11·5	—	7·6	53·4†
,, -	Retford - -	206	7·2	70·8	10·6	2·4	11·1	77·8†
Mansfield -	Mansfield - -	175	5·7	64·5	18·2	1·1	11·4	5·0‡
,, -	Woodhouse - -	135	1·4	65·9	21·4	0·7	11·1	4·0‡
,, -	Warsop - -	43	2·3	62·7	23·2	—	11·5	7·0‡
,, -	Sutton - - -	151	16·5	60·2	14·5	1·3	8·6	9·0‡
,, -	Pinxton - -	94	6·2	75·5	10·6	1·0	7·4	4·0‡
Newark - -	Foston - - -	43	20·9	46·5	18·6	—	13·1	6·0‡
,, - -	Bennington - -	116	24·1	57·7	7·7	0·8	10·3	3·0‡
,, - -	Newark - -	280	11·4	58·2	19·2	1·4	11·0	4·0‡
,, - -	Broughton - -	43	20·9	51·1	18·6	—	9·3	2·0‡
,, - -	Coddington - -	72	5·5	65·2	13·8	1·3	15·2	7·0‡
,, - -	Collingham - -	141	2·1	65·9	17·7	1·4	14·1	6·0‡
Nottingham -	St. Mary - -	337	4·4	60·8	16·0	0·2	18·2	—
,, -	St. Ann's - -	197	10·1	62·4	12·1	1·0	15·2	—
Radford - -	Radford - -	203	11·8	61·5	15·7	0·9	10·8	—
,, - -	Snenton - -	127	6·2	66·9	17·3	—	9·4	—
Southwell -	Southwell - -	215	1·8	79·5	6·9	0·4	11·6	54·2†
,, - -	Farnsfield - -	75	1·3	88·0	4·0	—	6·6	101·5†
,, - -	Cawnton - -	45	82·2	15·5	0·0	—	2·2	74·7†
,, - -	Sutton - - -	63	14·2	50·7	20·6	—	14·2	81·1†
Worksop - -	Worksop - -	253	6·3	66·4	10·6	0·3	16·6	5·7‡
,, - -	Blyth - - -	99	11·1	61·6	14·1	—	13·1	1·0‡
,, - -	Carlton - -	44	18·1	54·5	11·3	—	15·9	0·8‡
,, - -	Harthhill - -	21	4·7	76·1	9·5	—	9·5	5·7‡
,, - -	Anston - - -	13	7·6	76·9	7·6	—	7·6	6·3‡
Oakham - -	Oakham - -	281	35·9	43·4	8·1	1·0	12·4	—
,, - -	Market Overton -	23	30·4	43·4	17·3	—	8·2	—
,, - -	Empingham -	10	10·0	40·0	40·0	—	10·0	—
Uppingham -	Great Eastern -	125	23·2	52·8	10·4	—	13·6	64·4†
,, -	Hallaton - -	58	36·2	31·0	12·0	—	20·7	00·0
,, -	Uppingham - -	240	17·0	63·7	7·5	0·4	11·6	57·4†
,, -	Barrowden - -	130	25·3	46·9	12·3	—	15·3	57·1†
Atherstone -	Atherstone - -	187	8·5	67·3	10·1	1·0	13·9	41·5†
,, -	Polesworth - -	184	5·9	70·1	11·9	—	11·9	43·9†
Nuneaton -	Nuneaton - -	433	32·1	46·1	12·1	0·6	9·6	41·2†
,, - -	Chilver's Coton -	279	29·7	49·8	10·7	1·4	9·6	64·1†
Rugby - -	Rugby - - -	363	5·5	69·1	7·7	2·7	17·6	26·6†
,, - -	Dunchurch - -	110	2·7	60·0	10·9	0·9	26·3	38·4†
Southam - -	Southam - -	186	25·8	42·4	15·0	0·5	16·6	34·4†
Warwick - -	Leamington - -	439	16·6	55·8	8·2	2·4	19·3	20·1†
,, - -	Warwick - -	194	7·2	60·8	9·7	2·0	22·6	29·4†
Bromsgrove -	Redditch - -	473	5·4	72·0	7·3	0·4	15·0	79·8†
,, -	Alvechurch - -	102	9·8	74·5	11·7	—	3·9	22·3†
,, -	Bromsgrove - -	348	10·9	67·8	11·4	0·8	9·7	100·5†
Droitwich -	Droitwich - -	346	15·8	48·2	9·8	1·4	25·9	54·7†
,, - -	Hartlebury - -	53	32·0	47·1	15·0	—	5·6	66·1†
,, - -	Ombersley - -	122	20·4	63·1	10·6	—	5·7	60·2†
,, - -	Claines - - -	75	34·6	42·6	18·6	—	4·0	63·9†
Dudley - -	Tipton - - -	289	1·0	72·3	7·9	2·4	18·6	57·7†
,, - -	Sedgley - -	398	3·2	77·3	9·5	0·2	9·7	93·0†
,, - -	Dudley - - -	358	1·9	71·7	14·2	0·8	12·0	41·8†
,, - -	Rowley - - -	245	3·2	60·0	15·5	3·6	21·1	16·3†
Evesham - -	Lench - - -	212	28·3	43·3	6·6	0·9	26·3	42·5†
,, - -	Hampton - -	192	27·5	30·7	13·0	—	28·1	20·3†
,, - -	Littleton - -	132	27·2	40·1	9·9	—	22·7	14·7†
,, - -	Broadway - -	127	51·9	26·7	4·7	—	16·5	2·1†
Kidderminster	Wolverley - -	171	33·9	42·6	14·0	—	9·3	—
,, -	Bewdley - -	181	8·8	39·7	11·0	1·6	20·4	—
,, -	Lower Mitton -	240	15·0	60·4	8·3	0·8	16·2	—
,, -	Kidderminster -	600	22·1	53·0	7·5	1·1	17·3	—
Norton - -	Smethwick - -	278	22·6	48·2	14·0	1·7	15·1	67·9*
,, - -	Edgbaston - -	188	26·5	51·0	6·8	—	15·4	21·8*
,, - -	King's Norton -	88	25·0	53·4	12·5	—	9·0	51·1*

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* Calculations based on reports for three years ended 30th September 1861.
† Calculations based on reports for one year ended 30th September 1861.
‡ For three years per 100 of the population.

APPENDIX.

1. Local inquiries as to Vaccination.

2. Parts of Cambridgeshire, Derbyshire, &c., by Dr. Stevens.

Table E.—*continued.*

Union.	District.	Number of Children examined.	Per Cent. well vaccinated.	Per Cent. indifferently vaccinated.	Per Cent. badly vaccinated.	Per Cent. marked by Small-pox.	Per Cent. unvaccinated.	Infants vaccinated per 100 of registered Births from annual Returns.
Norton - -	Moseley - -	80	31·2	57·5	3·7	—	7·5	—
Martley - -	Martley, 1 - -	42	35·7	52·3	9·5	—	2·3	—
,, - -	,, 2 - -	42	23·8	69·0	2·3	—	4·7	—
Pershore - -	Grafton - -	38	23·6	52·6	7·8	—	15·7	—
,, - -	Fladbury - -	46	2·1	71·7	4·3	—	21·7	—
,, - -	Pershore - -	356	10·9	72·7	7·0	0·2	9·2	—
,, - -	Eckington - -	63	25·3	49·2	9·5	—	15·8	—
Shipston - on - Stour.	Moreton - -	202	6·4	66·8	6·4	—	20·3	53·3*
,, -	Campden - -	76	6·5	42·1	10·5	—	40·7	18·7*
,, -	Mickleton - -	66	3·0	48·4	15·1	—	33·3	3·4*
,, -	Shipston - -	59	11·8	59·3	8·4	1·6	20·3	10·6*
,, -	Brailes - - -	115	26·9	59·1	7·8	—	6·0	63·8*
Stourbridge -	Stourbridge - -	302	8·2	68·5	7·6	0·9	15·5	62·6*
,, -	King Swinford -	417	5·5	73·6	10·3	0·4	10·3	53·1*
,, -	Halesowen - -	384	1·8	73·9	10·6	1·0	13·5	103·9*
,, -	Cradley - -	86	1·1	73·2	12·7	1·1	12·7	
Upton - on - Severn.	Upton - - -	254	23·6	52·7	8·6	—	14·9	—
Worcester -	Worcester - -	778	31·7	51·1	5·6	1·2	11·4	N38·8* S64·3 W31·8

* Calculations based on reports for three years ended 30th September 1861.

In several of the districts, owing to the inferiority of all the cicatrices observed, the recorded small per-centage of well vaccinated children does not represent the entire defect in quality, nor does the amount of other vaccination tend so far to repair it as the figures would appear to show, as for instance in the Caxton district of the Caxton and Arrington union, the Balsham district of the Linton union, the Normanton, Melbourne, and Breadsall* district of the Shardlow union, the Broughton district of the Lutterworth union; the Grimsby district of the Caistor union, the Farnsfield district of the Southwell union and some others.

The best cicatrices observed were found in the Spondon district of the Shardlow union, the Causton district of the Southwell union, the Shilton district of the Hinckley union, the Brassington district of the Ashbourne union, in the districts of the Leicester union, and in the Edgbaston and Mosely districts of the King's Norton union.

The quality of the vaccination in Lincolnshire, more especially of the unions in the Fen district and in Great Grimsby, was very bad indeed, more especially in Great Grimsby. Here small-pox had been smouldering for three or four years, breaking out occasionally with greater violence, but never entirely disappearing. Though I ascertained that several of the children in the town had taken small-pox after presumed vaccination I was unable to discover whether any of the deaths by small-pox, which had been somewhat numerous, had occurred in any of these vaccinated children.

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* A complaint was made that the Vicar of Breadsall was in the habit of vaccinating to a considerable extent in the neighbourhood.

The table is very complete, embracing as it does all the most important districts, and those which from report or otherwise I considered ought to be inspected. In some of the districts I was unable to obtain so extensive an insight into the practice of vaccination as I wished, owing to the fact that the schools were broken up for regular holidays, or on account of the innumerable reasons for non-attendance caused by family distress, field or factory work, fairs, feasts, school treats, &c., &c.

3. CAUSE OF THE DEFECT.

From the foregoing statement and tables it is apparent that both the quantity and quality of the vaccination in the districts visited were, though in very different degrees, universally defective. The cause of the defect, which operated equally on the quality as on the quantity of vaccination, was the general want of a proper system for its performance.

As this cause is the result of a great variety of circumstances submitted in detail in the separate report on the unions visited, I think it best merely to epitomize these, following the order of my inquiry. In this way the duties of the guardians of the poor, to whom is entrusted the administration of the Vaccination Acts, and those of the contractors and registrars, will be considered and their neglect noticed, and the general working of the several legislative enactments and the various practices in vogue for carrying on vaccination can be systematically passed in review.

DUTIES OF THE GUARDIANS OF THE POOR.

The duties of the boards of guardians as to vaccination are as follows :—1, to divide the unions where necessary into vaccination districts ; 2, to contract with a legally qualified medical practitioner or practitioners for the vaccination of each district ; 3, to appoint such stations and fix such times for their attendance in the different districts as may enable the contractors efficiently to perform their duties and afford the greatest facilities to the public for obtaining vaccination ; 4, "To," in the words of the 16 & 17 Vict. c. 100. s. 1, " take the most effectual means for giving from time to time to all " persons resident within such district, due notice of the days and " hours at which the medical officer or practitioner contracted with " for such purpose will attend at such place to vaccinate," &c.

1. *Division of Unions.*—In all cases where necessary the unions had been divided into districts, in some cases only nominally, and with few exceptions these vaccination districts corresponded, sometimes with very slight variations, with the Poor Law medical divisions. Those unions in which the vaccination districts did not correspond with the Poor Law medical divisions were Louth, Uppingham, Peterborough, and Worcester, and these departures from uniformity did not work well. In Derby and Hayfield unions there had been no division into vaccination districts, and in Dudley, King's Norton, Stourbridge, and Market Harborough the divisions were only nominal.

2. *Contracts.*—In the great majority of the unions visited the guardians had entered into contracts with the public vaccinators in the form

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prescribed by the Poor Law Board ; but for the following districts the clerks to the guardians stated that no contract existed.

Union.	District.	Union.	District.
Ely	Witchford.	Lutterworth	Lutterworth.
Linton	Balsham.	,,	Pailton.
,,	Daxford.	Market Bosworth	All the five districts.
,,	Linton.	Daventry	Six out of the seven districts.
Newmarket	Cheveley.		
Derby	The whole union.	Radford	The two districts.
Hayfield	,, ,,	Rugby	Kilsby.
St. Ives	Warboys.	,,	Yelvertoft.
Ashby-de-la-Zouch	Ashby.	,,	Willoughby.
,, ,,	Packington.	Southam	All the four districts.
,, ,,	Wightwich.	Warwick	The three districts.
Hinckley	Stoke Golding.	Martley	Four out of the five districts.
,,	Wolvey.		

The contracts are of little practical use. The clerks to guardians are very frequently in ignorance of their existence. Public vaccinators often state that they have never signed such a document and are only undeceived on being shown their signature duly witnessed; and the terms and scheduled arrangements are almost universally departed from.

(*a.*) With regard to terms ; in the 457 districts visited I met with only 52 in which the guardians paid more than 1*s.* 6*d.* per case for vaccination within two miles of contractor's surgery, and 2*s.* 6*d.* beyond that distance, this being the minimum payment allowed by 16 & 17 Vict. c. 100. s. 6. This low payment is a general cause of complaint. I have been met on all hands by the remark that the only way to increase the quantity of vaccination is to increase the payment.

In many of the districts I visited the contractor was expected to ride or drive several miles to the vaccination station, and he often had to pay a toll-gate on his way. The statutory minimum of payment in such cases as these is not a sufficient inducement to diligence or activity on the part of the contractor. And diligence and activity are urgently required of contractors, for, notwithstanding the terms of the contracts, which only require the contractor to attend at stations to vaccinate, it is imperatively necessary in many districts, in spite of the most complete arrangement for stational vaccination, that the contractor should do a great deal of the looking up of unvaccinated children. This was apparent in very many of the thinly populated districts visited, as the north of Derbyshire, some parts of Cambridgeshire, Lincolnshire, and Huntingdonshire. In three districts of the North Witchford union the contracts for which were dated before 1853, the date of the Compulsory Act, the terms were 1*s.* 6*d.* per case for vaccination of children above six months old, and 2*s.* 6*d.* for those under this age, no extra payment for distance. In three districts of the Barrow-on-Soar union, in three districts of the Loughborough union, and in three districts of the Spilsby union, in all of which the contracts were dated prior to 1853, the terms and payment were less than the statutory minimum. In the four districts of the Solihull union, and the Byefield districts of the Daventry union the payment was the statutory minimum, although the contracts, dated before 1853, specified a lower sum. The terms mentioned in the 18 contracts for the Dudley union were the statutory minimum, but by a minute of the board of guardians 1*s.* 6*d.* per case only was paid irrespective of distance.*

(*b.*) *Scheduled arrangements.*—Wherever contracts existed and where the guardians had appointed times for the attendance of contractors at stations, those attendances had been duly scheduled to the contracts but these arrangements had been departed from in every way and almost universally. The only places in which the arrangements as scheduled to contract had not been departed from were the Caxton No. 2 district of the Caxton and Arrington union, in the five districts of the Leicester union, in the Worksop district of the Worksop union, in the Kidderminster No. 2 district of the Kidderminster union, and by two contractors in the Dudley union, ten districts out of 457, in many of which there were several contractors.

3. *Times appointed for attendance at stations.*—The chief reason for the neglect of stational vaccination, and therefore the primary cause of the defect in quantity of the vaccination, and doubtless to a considerable extent of that in quality, also appeared to be the extremely injudicious nature of the arrangements for the attendance of contractors at stations as appointed by the guardians and scheduled to the contracts. In many instances, perhaps in most, contractors have entered upon their work determined carefully to follow the scheme laid down, generally on their advice or at any rate with their concurrence. They have attended stations, often at a considerable distance from their dwellings, and found no applicants for vaccination. In many cases this result has followed the omission of the guardians to perform properly the next duty to be alluded to, that of duly giving public notice, but in numerous instances it has been the direct and unavoidable result of the nature of the fixtures for stational attendance.

The arrangements made for carrying on stational vaccination embraced attendances at every conceivable interval of time, daily, thrice weekly, twice weekly, weekly, fortnightly, monthly, every six weeks, bi-monthly, quarterly, "at any time when applied to," "at all convenient times," and in one instance, that of the Hinckley district of the Hinckley union, the following arrangements affording very doubtful facilities for obtaining vaccination were scheduled to the contract.

"At all such reasonable hours every day except Sunday, as the said Thomas S. Cotterill shall be at home between the hours of 8 and 10 o'clock in the morning and not otherwise professionally engaged."

In each of the eight districts of the Spalding union the following were the scheduled arrangements for the attendance of the contractors to vaccinate.

"Once a week at surgery for those living within two miles, and for those without those limits the said contractor will on application give attendance at convenient opportunities at the respective houses of such parties, both for vaccination and inspection."

The following table (F.) will afford a few examples of those districts or unions in which the attendances expected to be made by contractors at stations were most unnecessarily and injuriously numerous.

Although these attendances had not been made by the contractors, owing to their evident inutility, the substituted practice was rarely

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* I found in some of the medical registers that cases of vaccination, done at a greater distance than two miles from the surgery, had only been charged 1*s.* 6*d.*

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such as to remedy the evil accruing to vaccination, but only a means of saving the time of the contractor, which by the original arrangement would have been fruitlessly expended.

TABLE F.

Union.	District.	Births per Annum.	Number of Attendances at Stations prescribed by Contract.
Cambridge	-	759	1,252
Newmarket	Burwell	130	393
North Wichford	-	497	1,351
Whittlesea	-	242	834
Ashbourne	Ashbourne	162	377
,,	Mayfield	95	389
Shardlow	Breadsall	40	361
,,	Normanton	31	208
St. Ives	Wistow	19	52
Blaby	-	508	1,251
Melton Mowbray	-	675	1,456
Caistor	Caistor, No. 1	153	449
,,	Keelby	66	389
Lincoln	Metheringham	97	371
Sleaford	Blankney	107	413
Daventry	Byfield	65	337
Peterborough	-	1,234	3,775
Wellingborough	Higham Ferrers	265	677
Newark	-	1,016	2,631
Worksop	-	686	1,301
Uppingham	Hallaton	31	148
Solihull	Knowle	87	260
Bromsgrove	Belbroughton	120	260
Droitwich	Stock and Bradley	20	58
Evesham	Petworth	23	48
Pershore	-	392	920
Shipston-on-Stour	Brailes	129	196
,, ,,	Moreton	71	100
Stourbridge	-	2,899	3,753
Tenbury	Bockleton	87	100

In very few of the districts were the arrangements such as to lead to the hope that fair facilities had been afforded for securing either completeness in the quantity or efficiency in the quality of the vaccination. Owing either to the extremely numerous attendances required or to their being expected at injudicious intervals, obstacles were almost universally thrown in the way of the practice of the best kind of vaccination, that from arm to arm; therefore, it was discovered that the great bulk of the vaccination was done with the aid of stored lymph, and the results were proportionately unsatisfactory. The same inadequacy of arrangements led to another unfortunate result. As vaccination was rarely carried on in the only reasonable way—from week to week, the arms vaccinated were not often used for the purpose of supplying recent lymph for further vaccination; therefore little effort was made to induce attendance of parents with children on the eighth day for inspection. Thus a very large amount of vaccination was registered as successful without its having been duly inspected by the contractor. This was in many instances acknowledged by contractors.

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The result of this was that the mother's statement had constantly to be relied on as the only evidence to be procured of the success or non-success of the operation; and many of the reports so obtained were necessarily unreliable. A very great amount of ignorance exists on the part of the public, concerning what are the characteristic results of successful vaccination, and in the absence of inspection by the public vaccinator many cases of bad erysipelatous inflammation have been recorded as cases of successful vaccination.

4. *Public notification.*—The next duty imposed upon the guardians by the Compulsory Vaccination Act is to take the most effectual means of giving from time to time to all persons resident in the different districts due notice of the means provided for obtaining vaccination. This has been almost universally neglected. Although the arrangements generally, as shown above, were not such as to afford proper facilities for carrying on vaccination, if they had been more perfect they would not have been made available owing to the want of due information on the part of the public. In most unions a general public notice containing the arrangements entered into with contractors for the whole union had been posted at the time the 16 & 17 Vict. c. 100. was enacted (nine years since). This notice was soon obliterated and forgotten, and it had never been repeated, except in a few unions where the occurrence of small-pox had stimulated the authorities to unwonted exertions. In Caxton and Arrington, Chesterton, Bakewell, Chapel-en-le-Frith, Shardlow, St. Ives, Ashby-de-la-Zouch, Market Bosworth, Melton Mowbray, Caistor, Gainsborough, Glandford, Brigg, Holbeach, Spalding, Stamford, Brackley, Kettering, Bingham, Radford, Evesham, Pershore and Tenbury unions public notice had never been given. In the other unions visited it had been given twice, thrice, or four times during the nine years. In one or two unions notice had been given by means of a printed paper containing the arrangements for public vaccination which was given to parents, &c. on registering the births of their children, with the statutory notice.

DUTIES OF CONTRACTORS.

The strict duties of the contractors in regard to vaccination are to attend at the station at the times specified by contracts, there and then to vaccinate those who come and to inspect the results on the eighth day. To register the vaccination and the result of the inspection, and to give a certificate if successful to the parent or person in charge of the child, and to send a duplicate to the registrar of the sub-district in which the operation was performed. Under certain regulations, these duties may be performed by deputies.

As stated above in very few of the districts inspected did the contractor attend stations as prescribed by contract. From the nature of these arrangements compliance except in very few cases would have been fruitless. The result has been that the majority of the vaccination has been done by the public vaccinator calling from house to house and vaccinating the children with stored lymph; in many cases, either from long storage, or owing to the mode of its attempted preservation, the results produced have been as before alluded to, those attributable to the absorption of putrid animal matter alone. And these results have been recorded as successful vaccinations owing to the fact that the contractor's other engagements have prevented his making a long tour of inspections on the proper day, and that he has

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relied on the report of the parent or nurse received perhaps several weeks after the operation. Many children have in this way been left unprotected until on the invasion of small-pox they have sickened and died.

This has not had so much the effect of showing how groundless was the fancied security of the parents, as of spreading far and wide a disaffection for vaccination, which in such instances appears to have failed in affording its wonted protection.

Occasionally the contractors vaccinate a child and then arrange for others to be vaccinated from the recent arm on the eighth day. The only fault to be found with this plan is its want of completeness. As those appointments are made at the convenience of the public vaccinator, and as it often happens that that officer has but little leisure time, it results that a great number of children are overlooked, and but few others than those of his own patients or their friends attend these periodic vaccinations. Doubtless this mode conduces to improvement in quality.

The foregoing remarks naturally lead to a consideration of the mode of operating adopted by the contractors and their methods of storing lymph, both of which are naturally influenced by the nature of the arrangements for carrying on the practice of vaccination.

The practice of vaccinating from house to house, which prevailed to a large extent in the great majority of districts, necessitates the storage of lymph and directly influences the mode of operating.

Of the 488 contractors for the districts visited 15 stored the lymph more or less moist in a stoppered bottle ; 53 received the lymph on ivory points, which were kept in stoppered bottles or rolled in tin foil or oiled silk ; 104 did not so secure the charged points ; 66 placed a drop of lymph between pieces of glass wrapped in tin foil ; three used the dry crusts or scales taken from the arm after all appearance of fluid had disappeared, and two received the lymph on lancets. It was generally stated that all lymph taken as above indicated was used within a week ; but in many instances I ascertained that this was not the case, and that there was practically no limit to the period during which the lymph used might have been previously stored. The crusts were kept for months and were stated to be very effective after very long intervals. 25 of the contractors regularly used the hermetically closed capillary tubes. The other contractors, with the exception of three, who stated that they always used recent lymph taken from the ripe arm and directly inserted into that of the child to be vaccinated, adopted various methods, but the majority of them used points, for the supply of which they were dependent either on the National Vaccine Establishment or more frequently on neighbouring practitioners.

The mode of operating was either by one or several punctures, by a scratch or scratches, or by abrasions of the cuticle, into which the lymph was rubbed.

From the evidence of contractors it appeared that 39 were in the habit of making two abrasions of the cuticle and eight made only one, on each of which they generally secured a crop of vesicles ; 11 made four scratches ; 35 made three scratches ; one made two, and one made only one scratch ; but each scratch generally resulted in more than one vesicle ; 72 made four or more punctures ; 126 made three punctures ; 58 made two, and four acknowledged to making only one. Punctures rarely result in the production of more than one vesicle. From the returns as to quality of the vaccination previously given, it would appear that these modes of practice of the contractors must have been largely unproductive. In one instance the contractor informed me that he was in the habit of introducing the charged ivory points into a valvular puncture made by a lancet and then securing a pledget of lint over all with adhesive plaster, this he allowed to remain 24 hours. He stated that he had rarely seen untoward results from this practice.

Owing to the nature of the arrangements, the disuse of stations, &c., &c., and in some instances to the want of information on the part of the contractors, the practice of causing one or at most two vesicles largely prevailed ; this will appear plainly on reference to Table E., showing the quality of the vaccination as evidenced by the examination of children at public schools.

The hurried practice of house to house vaccination was, however, the chief cause of insufficient vesication ; time could not be afforded to enable the contractor to combat the prejudices of objecting parents, and it was stated by very many contractors that their vaccination was done after the manner dictated by the mother rather than that it should be left undone.

Great difficulty was universally experienced in securing the attendance of parents with children on the 8th day for the purpose of inspection, and indeed when the contractor called at the houses of the children for this purpose, he was constantly foiled in his efforts and continually unable to verify the results of his operation. The chief cause of this opposition on the part of parents was their fear that lymph would be taken from the child's arm, and that bad results would ensue.

The other duties of the contractors, viz., those of registering cases vaccinated and certifying to parents and registrars, were generally performed in a very loose way. The registers were almost invariably kept merely as account books between the contractors and the guardians, and, except in four instances, no notice whatever had been taken in them of the regulations of the Privy Council Order of 1st December 1859, and in these the lymph source only had been indicated. The existence of this Order of the Privy Council was not known in many unions. It was the practice of very few of the contractors to enter the case at the time of vaccination ; as a general rule no entry was made until the case was entered as successful, therefore but few opportunities were afforded of judging of the relative success of different modes of operating or of the advantage of any particular plan of lymph storage.

Very few contractors gave a certificate of the results to the parents, &c., as ordered by the 16 & 17 Vict. c. 100. s. 4 ; they stated that the people attached no value to them and destroyed them. It was stated that these certificates were always given when demanded by parents, &c.

Many of the contractors had assistants qualified and unqualified who vaccinated, but these, except in one instance, had not been approved by guardians and noticed in or upon contracts as provided by the regulations of Privy Council Order before alluded to.

Duties of Registrars.

The registrars as a rule performed all their duties in respect to vaccination with great regularity, and where this was not the case the neglect was either in consequence of the non-receipt of certificates of successful vaccination, and therefore the loss of payment for the large

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amount of work already done, or in some districts it was attributable to the fact that the registrar was a member of the medical profession whose other engagements prevented his paying the necessary attention to the duties of registration. The following instances of neglect are the most prominent met with :—

TABLE G.

Showing Instances of great Neglect on part of Registrars of certain Sub-Districts.

Union.	Registration Sub-District.	Remarks on Registrars.
Ely	Sutton	Omitted to deliver statutory notice.*
Newmarket	Newmarket	Not kept his register since 1854.
,,	Soham	,, ,, 1859.
North Wichford	March	,, ,, for last 9 months.
Wisbech	Leverington	,, ,, since 1857.
Bakewell	Matlock	,, ,, for 6 or 7 months.
Lutterworth	Lutterworth	All duties had been neglected for years.*
Market Bosworth	Market Bosworth	Not kept his register for 9 months.
Bingham	Radcliffe	,, ,, since 1859.*
Boston	Boston	Not kept his register since 1855, and only gave statutory notice on registering a first child.*
Caistor	Caistor	Not kept his register for 12 months.
Spalding	Gosberton	No notice given or entry made in register since 1854.*
,,	Donnington	No entry in register for 12 months.
Spilsby	Stickney	,, ,, since 1859.
Newark	Bennington	,, ,, for 12 months.
Solihull	Solihull	,, ,, since 1858.
Kidderminster	Bewdley	,, ,, for 12 months.
King's Norton	Harborne	Had given no notice for a long time.
Martley	Martley	No entry in register for 12 months.

* Also contractors.

N.B. In addition to the above, 20 sub-district registrars kept their book only as registers of successful vaccination, and made no entry except on the receipt of duplicate certificates from contractors. Therefore these books contained no minute of the delivery of the statutory notice in the case of uncertified children.

The registrars complained, and with reason, that their duties in respect to vaccination were not optional, were more onerous than the birth registry, were paid for at a much lower rate, and that the payment was contingent upon the receipt of certificates of successful vaccination from the contractors and other medical practitioners in their sub-districts, and that those certificates were rarely sent by any medical man who was not a contractor, and often neglected by those who held contracts.

The following instances will suffice to show how far these very useful officers suffer pecuniary loss, owing to the neglect of vaccinators to provide them with the duplicate certificates ordered to be furnished by the 16 & 17 Vict. c. 100. s. 4. On inspection of the registers of successful vaccination it appeared that very few registrars received more than one-third or at most half their proper number of certificates.

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TABLE H.

Specifying certain Sub-Districts the Registrars of which suffered material pecuniary Loss owing to the Neglect of the Contractors to send Duplicate Certificates.

Union.	District.	Certificates received.
Ely - - - -	Littleport - -	None for two years.
Bakewell - - -	Matlock - - -	None for one year.
Hinckley - - -	Burbage - - -	,, ,,
Loughborough - -	Leake - - -	None for three years.
Boston - - -	Swineshed - -	None.
Gainsborough - -	Marton - - -	None for five years from one contractor.
Spalding - - -	Gosberton - -	None for many years.* Had not entered his own.
Spilsby - - -	Stickney - - -	None for two years.
Daventry - - -	Weedon - - -	34 out of 740 births in two years.
Mansfield - - -	Warsop - - -	None for two years.
Solihull - - -	Solihull - - -	None for two or three years.
Warwick - - -	Leamington - -	Only 10 per cent. of the births.

* Also a contractor.

Where the registrars regularly and zealously performed their duties, vaccination was far more complete than it was in those districts in which, for some reason, the registrar had become lukewarm or careless.

Proceedings to enforce Vaccination.—Where the guardians have taken action under the "Vaccination Acts Amendment Act 1861," the registrars have been appointed to the duty of laying information and taking any necessary proceedings against persons who wilfully neglect to have their children vaccinated, or who for some supposed reason actually oppose the efforts of those appointed to carry on the public vaccination. In the following unions proceedings had been taken under the Compulsory Act prior to the date of the last-mentioned enactment:—Newmarket, Ashbourne, Glandford Brigg, Hinckley, Market Bosworth, Melton Mowbray, Horncastle, Daventry,* Peterborough, Huntingdon, St. Ives, St. Neots. In Newark and Warwick proceedings had been taken since the passing of the "Vaccination Acts Amendment Act, 1861," in Newark in 10 or 12 cases with perfect success, but in Warwick the summonses had been quashed by the magistrates on the ground that the information had not been laid within six months of the default. In Mansfield also proceedings would have been taken, but the clerk to the magistrates gave an opinion that the same result would follow in that union. It appeared that the provisions of the "Vaccination Acts Amendment Act, 1861," were not at all generally known, or these failures could hardly have occurred, nor would other offenders have been allowed to escape in localities in which active opposition to vaccination was known to exist.

SMALL-POX.

Small-pox had not appeared in an epidemic form of late in any of the districts visited, with the exception of the Grimsby district of the Caistor union, in which it had been present, occasionally breaking out

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* In this union the person proceeded against complied with the law and no fine was levied. The registrar who took the proceedings was not paid his costs, but a demand was made upon him as unsuccessful prosecutor to pay all the charges.

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with considerable virulence for three or four years; 20 deaths last year. There had been an epidemic in Leicester in 1858, 53 deaths occurred; also in Melton Mowbray last year; in Gainsborough in the winter of 1850–1859; a severe epidemic appeared in Grantham in 1860; a mild invasion in Peterborough last year (no deaths since January 1861) and a slight epidemic in Rugby about three years since.

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3. Oxfordshire, Berkshire, and Buckinghamshire, by Dr. Sanderson.

3.—DR. SANDERSON'S SUMMARY OF RESULTS of his INQUIRY in certain UNIONS in OXFORDSHIRE, BERKSHIRE, and BUCKINGHAMSHIRE.

THE inquiry related to the 28 unions which constitute the registration counties of Oxford, Berks, and Buckingham.

In the preparation of the following summary of my reports I have adopted the same order as in that which I had the honour of presenting a year ago on the state of public vaccination in Essex and Suffolk, the more important results of the inquiry being stated under four heads; viz., (1) the public arrangements for vaccination in each union; (2), the manner in which the duties of registrars are discharged; (3), the quantity of vaccination in each district, with special reference to the times and places at which vaccination is performed; (4), the quality of vaccination in each district.

The clerk, public vaccinators, and registrars of each union have been severally conferred with, and (with one exception) children attending elementary schools have been examined in each district, for the purpose of investigating the state of the population as regards protection from small-pox.

The following table exhibits the names of the unions inspected, the number of vaccination districts and of public vaccinators, the proportion which the number of vaccinations bore to that of the births registered during the three years ending Michaelmas 1861, and the number of children without marks of vaccination found in every hundred children examined in each union:—

TABLE I.

Union.	Number of Vaccination Districts.	Number of Vaccinators.	Number of Infantile Vaccinations in proportion to every Hundred Registered Births.	Number per Cent. of Children examined without Marks of Vaccination.
1. Banbury - -	7	7	48·3	14·7
2. Bicester - -	6	5	15·0	22·5
3. Chipping Norton -	4	4	48·0	13·4
4. Headington - -	2	2	37·1	18·9
5. Henley - -	6	6	55·6	13·1
6. Oxford - -	1	1	27·1	13·1
7. Thame - -	8	6	33·1	17·2
8. Witney - -	5	4	43·4	13·2
9. Woodstock - -	5	5	44·7	18·6
10. Abingdon - -	6	6	31·6	18·0
11. Bradfield - -	6	6	80·1	4·7
12. Cookham - -	4	5	80·5	13·4
13. Easthampstead -	4	4	59·8	5·9
14. Faringdon - -	4	4	69·5	4·7
15. Hungerford - -	5	5	60·1	10·5

Table I.—*continued.*

Union.	Number of Vaccination Districts.	Number of Vaccinators.	Number of Infantile Vaccinations in proportion to every Hundred Registered Births.	Number per Cent. of Children examined without Marks of Vaccination.
16. Newbury - -	3	3	39·9	15·3
17. Reading - -	3	3	59·7	7·8
18. Wallingford - -	5	5	42·3	13·4
19. Wantage - -	3	3	42·0	10·7
20. Windsor - -	8	3	68·6	10·8
21. Wokingham - -	4	4	70·3	7·8
22. Amersham - -	6	6	37·9	22·2
23. Aylesbury - -	7	7	39·5	13·9
24. Buckingham - -	3	3	21·4	19·9
25. Eton - - -	8	8	48·0	8·7
26. Newport Pagnell -	12	11	46·5	15·4
27. Winslow - -	3	3	22·2	16·4
28. Wycombe - -	12	11	36·3	17·0
Totals - -	150	140		

I. PUBLIC ARRANGEMENTS.

Contracts.

Contracts approved by the Poor Law Board exist in 25 of the unions inspected; in 18 there is a contract for each district, in 7 there are contracts relating to some of the districts only. In two unions it is stated that no contracts have been entered into by the guardians, viz., Headington and Amersham; the duties of public vaccinator being discharged by the district medical officers of each union. In the union of Abingdon the contracts were not forthcoming at my visit, but it was understood that they had formerly existed.

In all of the unions in which contracts exist the contractors are required to attend at stated periods at the appointed stations, excepting in the districts of Winkfield and Binfield (where it is stipulated that they shall vaccinate daily at their surgeries) and at Deddington, Henley, and Caversham, where they are bound to visit at the houses of those requiring vaccination.

Of 108 districts in which contracts exist, the stipulations relating to times and places appointed for vaccination are completely maintained in 20, partially maintained in 18, and entirely disregarded in 70.

Division of unions into districts for vaccination.

All of the unions have been divided into vaccination districts, and the divisions for vaccinations coincide in every instance with those for medical relief. In the union of Cookham an additional vaccinator has been appointed to whom no district has been assigned. It was found that with one exception all of the contractors were qualified. In the exceptional case the contractor possesses the licence of the Society of Apothecaries only. Qualified assistants are employed by eleven of the contractors, none of whom have been admitted as deputies under contract. Sixteen employ unqualified persons in vaccination, and two have assistants whose qualifications are partial, consisting, in one case, of the vaccination certificate only, in the other of the licence of the College of Surgeons, Edinburgh.

Qualifications of contractor.

Contractor's register.

In 25 unions the register is kept by all of the contractors, in one it is kept by some only, and in two it is not kept at all. In one district entries were found in the register of the source from which the lymph used in each vaccination was obtained, the number in the register of the case of vaccination from which the supply was derived being entered in a special column. Most of the contractors make no entries of unsuccessful cases of vaccination, and among those who do, there is so much variety in the meaning attached to the expression that the record is not of the slightest value. I met with only two instances in the course of the present inquiry in which *all* cases in which vaccination was performed were recorded in accordance with the instructions contained in the form of contract which has been in use since 1853 under the approval of the Poor Law Board.

The annual returns to the Poor Law Board are either founded on the charges for vaccination, and prepared in the clerk's office, in which case they are reliable,

The annual returns are usually founded on the registers of vaccination sent in to the guardians periodically or from time to time by the contractors along with their claims for payment. This I found to be the case in 24 of the unions visited; in 19 of these unions the contractors are allowed to send in the register kept by them according to contract, but in the other five they are required to furnish a duplicate in the same form. This practice is inconvenient, as it entails on the vaccinator much useless expenditure of time. As regards the accuracy of the annual returns, it is of little importance which of these plans is adopted, for in either case the documents from which it is derived are identical with those which form the basis of the charges for vaccination, and for this reason are subjected to a much more careful scrutiny than they would be as mere statistical records.

or prepared by the contractors.

In four unions the annual return for each district is prepared by the public vaccinator irrespectively of the vaccination charges, and transmitted to the clerk of the union. In all of these cases the return is found to be inaccurate. From the variety of practice which prevails among contractors as to the entry of unsuccessful cases, those columus of the returns which refer to unsuccessful vaccinations are altogether unworthy of dependence.

II.—DUTIES OF REGISTRARS.

The divisions of the unions for registration do not accord with those for vaccination.

The 28 unions inspected are divided into 79 registration districts. The limits of seven of the districts coincide with those of the districts for vaccination; in five of these instances the districts are identical, in the other two each registration district comprises three vaccination districts. Of the remaining 72, the limits of 49 have no relation whatever to the divisions for vaccination; in 23 the correspondence is incomplete.

Register of successful vaccination.

The "Register of successful Vaccination" is regularly kept in 41 of the districts; it is irregularly kept in 28, and not kept at all in 9.* The irregularity consists in 25 cases in the omission of the entries of children who die or leave the district before the registration of birth; in two districts entries are made in the register only on the receipt of duplicate certificates, and in one district the minute of delivery of notice is not entered.

Delivery of notice.

Seventy-one of the registrars regularly deliver the notice of the requirement of vaccination; five never deliver it, and one only occasionally.

Notification of times and places appointed for vaccination.

Notifications of obsolete arrangements scheduled in contracts are delivered by the registrars of 18 districts; of scheduled arrangements stated to be actually in force in six districts; of obsolete arrangements not in accordance with contracts in eight districts. Three registrars notify arrangements in actual operation differing entirely from those stipulated in the contracts, for which they have been substituted by the public vaccinators, while in three districts the

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* One of the registrars of Amersham union was not conferred with.

announcement is partly in accordance with the schedule. Thirteen registrars notify only the name of the contractor, and seven insert only the name and place of vaccination. The remaining 14 registrars make no announcement on the notice whatever.

Efforts made by the registrars to promote vaccination in addition to their legal duties.

Thirty-one of the registrars have employed special means to promote the extension of vaccination in their districts. Eight of them have instituted legal proceedings against persons neglecting the vaccination of their children, of whom five have obtained convictions, while three have incurred the expenses of unsuccessful prosecution. Lists of unvaccinated children have been furnished, with more or less regularity, by 26 registrars, and 15 have made personal inquiries as to the prevalence or neglect of vaccination in their districts.

The combination of the office of registrar with that of medical officer is not conducive to efficient discharge of its duties.

Twenty-three of the registrars are relieving officers. Of those who furnish lists to the contractors, 11 hold this post. Seven of the registrars are also public vaccinators, of whom two keep no register and give no notice of the requirement of vaccination. Of the whole number, two only avail themselves of the opportunities afforded by the office of registrar for the purpose of promoting vaccination, and these two confine their efforts to their own vaccination districts.

III.—QUANTITY OF VACCINATION.

TABLE II.

Showing the Numbers and Ages of those Vaccinated in each District, and the Number of Children without Marks of Vaccination in the Schools.

Name of Union.	Name of District.	Population.	Average annual Number of Vaccinations returned to the Poor Law Board for the Three Years ending September 29, 1861.	Proportion of the annual Number of Vaccinations to every Thousand of the Population in 1861.	Proportion of the annual Number of Infantile Vaccinations to every Thousand of the Population in 1861.	Number of Certificates annually received by Registrars.	Number of Children without Marks of Vaccination in every Hundred examined in the Schools.
OXFORDSHIRE.							
Banbury - -	Banbury - -	11,065	116	10·5	7·2	88	21·8
	Bloxham - -	4,822	100	20·7	16·9	85	14·6
	Chipping Warden	1,538	61	39·5	38·0	51	9·0
	Cropredy - -	3,499	118	33·7	25·1	107	9·1
	Hornton - -	3,062	92	30·3	23·6	68	3·2
	Middleton Cheney	2,451	50	20·3	18·3	40	2·7
	Swalcliffe - -	3,724	117	31·5	26·8	100	16·5
Bicester -	Bicester - -	5,604	44	7·8	3·2	18	34·8
	Cottesford - -	964	17	17·6	12·5	8	21·6
	Heyford - -	2,542	1	0·6	0·5	0	44·1
	Islip - - -	3,706	74	19·9	10·0	113	5·4
	Piddington - -	644	5	8·2	3·0	0	41·3
	Stoke Lyne - -	2,174	36	16·5	7·8	11	6·5
Chipping Norton	Chipping Norton -	5,580	94	16·8	10·2	90	23·5
	Churchill - -	3,855	83	21·6	16·1	60	10·7
	Charlbury - -	6,322	151	23·7	19·5	106	2·7

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TABLE II.—*continued.*

Name of Union.	Name of District.	Population.	Average annual Number of Vaccinations returned to the Poor Law Board for the Three Years ending September 29, 1861.	Proportion of the annual Number of Vaccinations to every Thousand of the Population in 1861.	Proportion of the annual Number of Infantile Vaccinations to every Thousand of the Population in 1861.	Number of Certificates annually received by Registrars.	Number of Children without Marks of Vaccination in every Hundred examined in the Schools.
Headington -	Headington - -	13,506	217	16·0	15·0	*	8·6
	Wheatley - -	3,679	61	16·7	2·4	0	34·7
Henley - -	Caversham - -	2,582	68	26·3	21·7	51	3·6
	Grays - - -	2,948	95	32·2	20·7	63	13·6
	Hambledon - -	2,116	52	24·7	22·3	60	11·9
	Henley - -	4,661	82	17·6	15·4		10·5
	Nettlebed - -	1,976	48	24·3	18·2	28	19·4
	Watlington - -	3,917	57	14·5	14·5	57	17·0
Oxford - -	Oxford - -	20,037	225	11·2	6·3	212	13·1
Thame - -	Shirburn - -	2,324	28	12·0	8·6	11	18·2
	Aston Rowant -						
	Brill - - -	1,991	55	27·5	3·0	42	29·1
	Great Milton -	2,423	59	24·3	14·0	44	18·2
	Little Milton -						
	Long Crendon -	3,287	68	20·7	6·3	65	29·5
	Thame - -	4,917	126	25·3	17·0	137	11·4
	Waterperry - -	347	3	8·6	0·8	0	34·7
Witney - -	Bampton, No. 1 -	2,927	60	21·0	17·8	40	8·9
	Bampton, No. 2 -	2,702	26	9·6	8·5	20	17·9
	Burford - -	4,808	103	21·4	17·4	103	5·9
	Ensham - -	5,237	103	19·7	14·3	72	4·3
	Witney - -	7,478	81	10·8	7·2	103	29·5
Woodstock -	Deddington, No. 1	2,870	12	4·2	0·8	3	44·1
	Deddington, No. 2	2,504	34	13·5	11·1	33	22·1
	Kidlington - -	3,278	91	27·7	19·8	37	13·9
	Woodstock, No. 1	2,580	18	6·9	5·0	11	11·7
	Woodstock, No. 2	3,004	96	31·9	30·9	95	6·5
BERKS.							
Abingdon - -	Abingdon, No. 1	10,171	128	12·3	8·5	41	15·9
	Abingdon, No. 2					21	30·1
	Kingston - -	2,721	59	21·7	18·0	82	10·4
	Sutton Courtney -	2,263	38	16·8	8·0	61	8·4
	Cumner - -	2,377	29	12·2	10·5	0	6·6
	Nuneham - -	2,973	38	12·7	9·1	43	2·0
Bradfield - -	Theale - -	2,913	146	50·2	45·1	0	2·3
	Whitchurch - -	3,021	76	25·2	22·8	45	8·4
	Aldermaston -	1,744	44	25·2	22·3	32	8·1
	Mortimer - -	3,165	98	31·1	24·1	61	2·1
	Pangbourne -	3,136	52	16·5	14·3	0	1·9
	Bucklebury - -	1,756	30	17·1	12·5	0	†

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* No return.

† The only school in this district was closed at the period of my inspection.

Table II.—*continued.*

Appendix.

I. Local inquiries as to Vaccination.

3. Oxfordshire, Berkshire, and Buckinghamshire, by Dr. Sanderson.

Name of Union.	Name of District.	Population.	Average annual Number of Vaccinations returned to the Poor Law Board for the Three Years ending September 29, 1861.	Proportion of the annual Number of Vaccinations to every Thousand of the Population in 1861.	Proportion of the annual Number of Infantile Vaccinations to every Thousand of the Population in 1861.	Number of Certificates annually received by Registrars.	Number of Children without Marks of Vaccination in every Hundred examined in the Schools.
Cookham - -	Bisham - -	665	15	22·6	15·1	14	18·2
	Bray - - -	6,715	198	29·5	17·3	125	20·6
	Cookham - -	4,467	216	48·3	38·6	167	2·6
Easthampstead -	Binfield - -	1,371	9	6·5	5·1	0	5·0
	Bracknell - -	2,207	104	47·2	26·2	104	8·1
	Sandhurst - -	1,271	36	28·3	21·3	5	5·1
	Winkfield - -	2,508	39	15·5	10·8	0	5·4
Faringdon - -	Buckland - -	5,201	125	24·1	23·3	127	3·5
	Faringdon - -	4,986	139	27·8	23·3	125	4·2
	Lechlade - -	2,601	69	26·5	23·8	72	2·2
	Shrivenham - -	2,900	45	15·5	11·4	26	5·9
Hungerford -	Great Bedwyn -	4,087	119	29·2	28·8	74	5·5
	Hungerford - -	4,222	61	14·4	10·1	40	22·5
	Kintbury - -	3,368	91	26·8	23·6	91	6·4
	Lambourn - -	4,115	96	23·3	22·6	96	14·8
	Ramsbury - -	4,072	77	18·9	14·2	31	17·1
Newbury - -	Newbury - -	9,040	154	17·0	11·9	82	13·8
	Speen - - -	6,899	191	27·6	15·3	161	9·3
	Thatcham - -	4,059	76	26·8	10·6	93	20·5
Reading - -	St. Giles - -	10,200	295	29·0	20·6	*	9·1
	St. Lawrence -	4,736	297	20·9	15·8	*	8·1
	St. Mary - -	10,940	358	32·7	20·7	*	5·9
Wallingford -	Cholsey - -	3,738	84	22·4	18·4	69	11·3
	Dorchester - -	4,801	104	21·7	11·6	73	19·1
	Wallingford - -	5,476	75	13·7	9·5	10	12·2
Wantage - -	Blewbury - -	2,136	77	36·3	26·8	61	2·7
	Brightwaltham -	1,917	60	31·2	17·2	27	5·8
	Hendred - -	2,233	86	38·6	28·7	92	6·3
	Ilsley - - -	3,718	99	26·7	4·6	46	9·0
	Wantage - -	7,304	97	13·2	8·7	108	25·5
Windsor - -	Egham - -	6,731	143	21·3	16·6	121	12·3
	Sunninghill - -	2,196	63	25·5	24·1	56	16·4
	Windsor - -	12,450	345	27·7	14·4	150	9·4
Wokingham -	Shinfield - -	2,460	70	28·5	21·6	63	7·3
	Sonning - -	1,948	64	32·8	24·1	34	11·5
	Wargrave - -	4,368	113	26·4	18·5	56	2·6
	Wokingham -	5,678	137	24·2	21·7	108	6·6
Bucks.							
Amersham - -	Amersham - -	2,818	45	16·0	15·3	41	6·7
	Beaconsfield -	1,996	38	19·3	13·0	48	23·2

* No returns were received from the registrars of Reading Union.

TABLE II.—*continued.*

Name of Union.	Name of District.	Population.	Average annual Number of Vaccinations returned to the Poor Law Board for the Three Years ending September 29, 1861.	Proportion of the annual Number of Vaccinations to every Thousand of the Population in 1861.	Proportion of the annual Number of Infantile Vaccinations to every Thousand of the Population in 1861.	Number of Certificates annually received by Registrars.	Number of Children without Marks of Vaccination in every Hundred examined in the Schools.
Amersham - -	Chalfont - -	2,560	36	14·2	5·5	36	21·5
	Chesham - -	6,672	175	26·3	20·0	0	10·3
	Missenden - -	2,366	44	18·6	12·7	10	44·4
	Penn - - -	1,627	15	9·3	4·3	0	55·5
Aylesbury - -	Wingrave - -	2,568	64	25·2	12·4	43	9·7
	Aston Clinton -	2,678	38	14·1	4·4	31	16·5
	Aylesbury - -	8,213	152	18·7	10·1	41	15·3
	Whitchurch - -	2,672	130	48·7	31·7	92	19·8
	Waddesdon - -	2,978	47	15·8	12·4	37	12·1
	Haddenham - -	2,875	89	32·0	24·7	103	3·8
	Wootton - -	1,616	33	20·4	6·2	40	29·1
Buckingham -	Buckingham -	6,373	153	24·0	7·0	164	13·0
	Leckhampstead -	4,036	81	18·2	4·7	48	33·7
	Marsh Gibbon -	2,825	64	22·7	12·7	37	21·0
Eton - - -	Burnham - -	4,433	64	14·4	7·0	102	8·6
	Colnbrook - -	1,545	28	18·3	9·7	50	15·4
	Eton - - -	4,104	113	28·5	15·8	61	1·8
	Denham - -	1,070	15	14·3	13·6	18	11·5
	Iver - - -	3,988	89	22·3	19·8	67	10·4
	Stoke - - -	2,147	39	18·1	13·0	19	11·9
	Upton-cum-Chalvey.	4,690	95	20·2	14·0	0	3·3
Newport Pagnell	Linford - -	1,992	10	5·1	2·5	7	14·0
	Crawley - -	1,411	84	59·5	38·3	31	5·3
	Hanslope - -	2,130	47	22·0	12·2	14	37·5
	Sherrington - -	1,802	95	52·7	27·6	57	23·5
	Fenny Stratford -	4,735	182	35·0	18·6	77	15·0
	Bradwell - -	2,261	94	41·7	24·4	35	8·3
	Newton - -	714	21	29·4	22·4	15	3·9
	Olney - - -	4,000	45	11·1	8·5	33	6·6
	Newport Pagnell -	3,823	39	11·1	4·7	35	16·9
Winslow - -	East Claydon -	1,901	90	46·3	5·7	90	26·3
	Drayton - -	3,851	117	30·0	8·8	55	10·7
	Winslow - -	3,511	95	27·0	8·5	86	16·3
Wycombe - -	Wycombe Borough	6,060	43	7·1	4·5	28	29·0
	Chipping Wycombe	4,153	46	11·3	4·5	3	12·0
	West Wycombe -	2,708	66	24·3	17·0	53	9·5
	Great Marlow -	4,659	128	27·5	20·8	*	12·6
	Risborough - -	5,162	163	31·6	17·0	90	11·3
	Wendover - -	3,133	98	31·3	19·8	80	8·2
	Wooburn - - Little Marlow -	3,210	41	12·8	7·5	47	25·2
	Stokenchurch -	2,898	64	22·1	10·3	28	30·5

* No return.

Quantity of vaccination. Sources of information. The annual return.

Vaccinators' registers.

The ledger.

Information relating to the numbers and ages of those vaccinated in each district, during the three years preceding September 29th, 1861, was obtained from the annual returns made by the guardians to the Poor Law Board of the vaccinations performed in each district, which I had the opportunity of examining before commencing the inquiry. As, however, much more detailed statements were necessary in order to judge of the local distribution of vaccination in parishes, and to investigate variations in the relative number of vaccinations performed occurring within periods of time much shorter than a year, it was necessary to amplify (and in many instances correct) the numerical facts deducible from the returns by the examination of other documents. In those unions in which vaccination registers had been kept by the contractors, these books usually furnished all the information required. But as regards districts in which the register was either not kept or kept in so irregular a manner as to be obviously unworthy of confidence, I was under the necessity of deducing the number of vaccinations performed during the period comprised in the inquiry from the half-yearly charges for vaccination recorded in the ledger of the union.

Tabulation of vaccinations recorded in each district, according to the parish in which each vaccination is performed, and according to the ages of those vaccinated.

Parochial vaccination rates.

From these sources two tables were prepared for each of the districts visited, the one showing the number of persons vaccinated in each parish comprised within its limits, in each of the 12 quarters of the three years already referred to, the other exhibiting the proportion per cent. of those vaccinated who were of the several ages following :— 0–3 months, 3 months to 12 months, 1–2 years, 2–5 years, 5–12 years, and 12 years and upwards. To the first of these tables a column was added, in which the population of each parish, according to the census of 1861, was stated, by the comparison of which with the numbers of vaccinations it could be determined whether any defect or excess indicated by the vaccination rate of the whole district was referable in an equal degree to all of the parishes comprised in it, or confined to particular localities. In this way the importance of the operation of apparently trivial local circumstances (such as the influence of an active clergyman, schoolmaster, or relieving officer, the prevalence of certain occupations or forms of religious belief) could be shown. The second table affords a useful amplification of the facts relating to age yielded by the annual returns. It shows whether in any district in which a large number of persons above the age of one year have been vaccinated, this number is made up principally of young children (and is consequently expressive of the prevalence among the people of a habit of postponement of vaccination) or of grown persons, in which case it may be assumed either that vaccination has been much neglected, or that many secondary vaccinations have been performed. As regards infantile vaccinations the proportion of cases in which the statutory limit of age has been exceeded is also exhibited.

Postponement of vaccination and re-vaccination indicated by the district age tables.

Influence of the actual practice of the contractor, as regards the time and place of vaccination, on quantity.

In the districts inspected by me in 1861 it appeared that the quantity of vaccination was more influenced by the vaccinating arrangements actually adopted by the contractors than by any other cause, and that such arrangements as implied a systematic personal inquiry into every case of neglect or postponement of vaccination were invariably found to be most successful. With these facts in view I have specially directed my inquiries to the question in how far the variations of the quantity of vaccination, recorded in each district, could be accounted for on the sole ground of variations in the vigilance and constancy with which what I have called "supervision" of vaccination is maintained, and, if under any circumstances it may be dispensed with, what are the conditions necessary to the success of a self-acting system.

Varieties of practice which are met with.

The contractor may either inquire into the state of vaccination of his district, making it his business to see that all of the inhabitants are vaccinated, or he may content himself with vaccinating such persons as apply for themselves or are brought to him by their parents. In the latter case he may confine the performance of vaccination to his surgery, or may fulfil the stipulations of his contract by attending at the stations and times appointed by the guardians. In the former case, his supervision may consist merely in "whipping up" or coaxing such parents as he may chance to come across in his rounds, or, on the other hand, he may systematically inform himself of all cases of neglect or postponement, either by lists furnished by the registrar of the district, by his midwifery list, or by other private sources of information.

Districts may be classified for description according to these varieties.

In relating the most important facts bearing on the numerical prevalence of vaccination, I propose to classify them, not as in my last report, according to the vaccination rates, but according to the adoption by the contractor of one or other of the varieties of practice above referred to. In doing so, it will be desirable to omit for the present those districts which are exclusively urban (*i.e.*, those which form parts of towns having more than 5,000 inhabitants), for the circumstances which affect vaccination in such districts are essentially different from those which are in operation in the country.

RURAL DISTRICTS.

Districts in which vaccination is performed on application at the contractor's surgery, but at no stated time.

In 103 districts, which are either entirely or for the most part rural (those being excepted in which either the contractor had been very recently appointed, so that the state of his district could have no relation to his performance of duty, or in which, for other reasons, satisfactory information could not be obtained) the arrangements of the contractors are as follows:—In 10 districts the contractor vaccinates at his surgery at any time. In these districts the mean of the numbers of vaccinations of persons of all ages annually performed in every thousand of the population (mean of the vaccination rates) is 13·7, and that of the vaccinations of infants (mean of the infantile vaccination rates) is 9·5.

In such districts lower vaccination rates prevail than in any others.

Beaconsfield and Penn (Amersham).

Denham (Eton).

Winkfield and Binfield (Easthampstead).

Beaconsfield (V.R.* 19·3, I.V.R.* 13·0; per-centage of unprotected children seen in the schools 23·2). Penn (V.R. 9·3, I.V.R. 4·3; percentage of unprotected children 55·5). In both of these contiguous districts a strong prejudice exists against vaccination. The parents not only fail to apply for it, but in some instances have violently obstructed the medical officers in their endeavours to vaccinate at the houses. The inhabitants of Penn district are now compelled to bring their children to Amersham (a distance of 5 miles from the village) to the surgery of the public vaccinator, who states that he has entirely ceased to attend in the district for vaccination on account of the refusal of the guardians to pay him the fee of half-a-crown to which he would be entitled for each such attendance. He states that the infants in his district are now almost all unvaccinated. Denham (V.R. 14·3, I.V.R. 13·6; 98 children examined, of whom 11·5 per cent. unprotected). The surgery of the vaccinator is at Uxbridge, 2 miles from the village of Denham; he has no time to attend for vaccination in his district, which is contiguous to Beaconsfield. Winkfield (V.R. 15·5, I.V.R. 10·8; 148 children examined, of whom 5·4 per cent. unprotected). Binfield (V.R. 6·5, I.V.R. 5·1; 140 children examined, of whom 5·0 per cent. unprotected). The remarkable discrepancy between the vaccination rates and the results of the inspec-

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* Here and in the following paragraphs, the letters V.R. and I.V.R. are used to designate the vaccination rates and infantile vaccination rates respectively.

Wallingford.

Amersham.

Newport Pagnell.

tion of schools in these two adjoining districts arises from the fact that most of the children are vaccinated by a neighbouring contractor and registrar in the same union, in whose registration district both of them are included. The inhabitants of all three districts are in the habit of taking their children to the registrar, who is also well known in his medical capacity, and avails himself of his official intercourse with the people to induce them to attend. Wallingford (population of the town 2,793, V.R. 9·6; 150 children examined, of whom 12 per cent. unprotected). The contractor is of opinion that in this town the defect is for the most part compensated by private vaccination. No means are used to promote the vaccination of the poor. Amersham (V.R. 16·0, I.V.R. 15·3; 89 children examined, of whom 6·7 per cent. unprotected). The public vaccinator states that besides his own private vaccinations, which amounts to 15 annually, many are performed by other practitioners, so that he believes that few children are neglected. Newport Pagnell (population of the town 3,823; V.R. 11·0, I.V.R. 4·7; 213 children examined, of whom 16·9 were unprotected). In this town four public vaccinators reside, three of whom hold rural districts and are said to vaccinate many of the inhabitants. But this statement is not supported by the numbers of vaccinations charged in the ledger to the district, so that there is no doubt that vaccination is much neglected.

Districts in which vaccination is performed at the surgery of the contractor on a stated day in each week.

The high vaccination rates which prevail in these districts are due, in three cases out of four, to special local circumstances.

In four districts the contractor vaccinates at his surgery only, but attendance is given on a stated week-day. Of these four districts the mean of the vaccination rates is 28·4, and the mean of the infantile rates 17·3. These high numbers are referable to two of them exclusively in which special conditions favourably affecting vaccination exist, viz., Bracknell (V.R. 47·2; 112 children examined, of whom 8·1 per cent. unprotected), where the returns include many vaccinations not performed in the contractor's district, and Eton (V.R. 28·5, I.V.R. 15·8; 107 children examined, of whom 1·8 only unprotected), where small-pox had recently prevailed (*see* Windsor). In the other two districts no such exceptional conditions exist. At Hanslope (V.R. 22, I.V.R. 12·2; 48 children examined, of whom 37·5 per cent. unprotected) the contractor objects "on principle" to looking-up his cases, but attends regularly for vaccination on the appointed days. The district of Headington (V.R. 16·0, I.V.R. 15·0; 196 children examined, of whom 8·6 per cent. were unprotected) is partly rural, partly urban. The parishes of St. Clement's, St. Giles', and St. John's, with an aggregate population of 7,500, form part of Oxford; the rural parishes are inhabited by 6,100 persons. The contractor resides in Oxford, out of his district, so that, as in the cases of Penn and Denham, parents have to bring their children for several miles to be vaccinated. This being the case, it is somewhat remarkable that the vaccination rate in the rural parishes (20·5) is much higher than in the town districts (12·5), where the people reside close to the station. The latter rate coincides with that for the rest of Oxford (11·2). The superiority of the rural rate to that of Penn may probably be attributed to the circumstance that in the case of Penn the town in which the contractor resides is not that to which the inhabitants resort for marketing, whereas the contrary is the case in Headington.

From the preceding examples it may be inferred that when the facilities offered for vaccination do not extend beyond the surgery of the contractor, not more than one-third of the children are likely to be vaccinated, unless under the influence of exceptional causes, such as the prevalence of small-pox, or the employment of systematic supervision.

Districts in which vaccination is actually performed at the times and places scheduled in the contracts.

In 12 districts the contractor attends, according to the stipulations of his contract, at the times and places appointed by the guardians. The mean of the vaccination rates is 17·2, and of the infantile vaccination rates 11·5.

Kintbury (Hungerford).
Shinfield (Wokingham).
Sandhurst (Easthampstead).
Wokingham.

In the districts of Kintbury, Shinfield, Sandhurst, and Wokingham, all of which excepting the last are entirely rural, stational vaccination has been carried out with considerable success. In Kintbury (V.R. 26·8, I.V.R. 23·6; 109 children examined, of whom 6·4 unprotected), the contractor is also registrar. Vaccination is performed principally by his assistant (L. S. A.) who from time to time prepares from the register, lists for each parish, by which he "looks up" the parents of children, requiring them to attend at the stations. In Shinfield district (V.R. 28·5, I.V.R. 21·6; 129 children examined, 7·3 per cent. of whom unprotected) the registrar furnishes lists from time to time, which are systematically worked up by the contractor, in the same manner as at Kintbury, who states that parents attend very willingly. In the adjoining district of Sandhurst the contractor's assistant (not qualified), who resides at some distance, professedly attends at a public house in the village every Monday, according to contract, but vaccinations are rarely performed excepting in spring and autumn, when the registrar, who resides on the spot, takes great pains in assembling the children of fit age for vaccination, all of whom can be vaccinated in two or three attendances. In the town of Wokingham (population 4,154, V.R. 22·5; 160 children examined, 6·6 per cent. unprotected) the contractor, who devotes much time to vaccination, vaccinates every Monday, and believes that there is very little neglect, the numerical defect being entirely made up for by private vaccination. In the rural parishes he attends monthly. During the last few years he has taken proceedings (followed by conviction) in three cases, either in respect of neglect of vaccination or of failure to attend for inspection. Having been himself registrar until a recent period, he has been constantly informed as to the quantity of vaccination in his district, and now obtains information from his successor.

In four districts stational vaccination is successfully carried out, in consequence of the supervision exercised by the contractor or registrar.

It thus appears that in these four districts the success of stational vaccination was owing to the use made by the public vaccinator of the registration of births; this advantage was rendered more available than it would otherwise have been by the coincidence of limit in these cases of the districts for registration and vaccination.

Bray (Cookham).

In the district of Bray (population 6,715, V.R. 22·5, I.V.R. 13·5; 155 children examined, of whom 20·6 unprotected), 773 vaccinations were charged to the guardians during the three years preceding Michaelmas 1861, or 38·2 in every thousand of the population annually. Of these vaccinations 453 are shown by the returns to have been performed by the contractor, leaving an excess of 220. It further appears from the returns[*] that 404 persons were vaccinated during the same period in Bray district by other contractors of the union, so that the number returned to the Poor Law Board exceeded the actual number charged by 84. Whatever may be the explanation of this discrepancy, it is perfectly clear that the vaccinations must have exceeded the births by at least 150 in the three years,[†] a fact which appears

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[*] In the rest of Cookham Union 523 vaccinations were charged to the guardians during the three years ending Michaelmas 1861; 927 vaccinations were returned to the Poor Law Board for the same period; so that 404 vaccinations must have been performed by the contractors in the district of Bray. The vaccination rates stated above are calculated on the contractors' vaccinations exclusively, and consequently differ from those given in the table, in calculating which the vaccinations returned by the additional contractor have been distributed between the districts in which he vaccinates.

[†] If the births in Bray district during the three years 1859–61 were as numerous as in the rest of the union, the number born must have been 640. The vaccinations were 773, according to the charges, or 857 = 404 + 453 according to the returns.

the more extraordinary when connected with the unusual proportion of unprotected children found in the schools. The contractor states that he attends regularly at the stations, never vaccinating elsewhere. Of the other two contractors who vaccinate in the district, the one (to whom the extraordinary excess is mainly due) visits from house to house, the other (to whom no district other than the whole Union has been assigned) vaccinates at his surgery at Maidenhead.

When no supervision is exercised, stational vaccination produces very low vaccination rates.

In seven districts contractors professedly attend regularly at the stations, but no supervision is exercised; in these the mean of the vaccination rates is 10·9.

Bicester.

Bicester (population of the town 3,387, V.R. of town 3·8, of rural parishes 16·0; children examined, 130 in the town, 92 in the rural parishes, 54 per cent. unprotected in the town, 2 per cent. in the country). The contractor has attended regularly at the stipulated times and places since he was appointed in 1856. During this period the annual number of vaccinations in Bicester has gradually declined, none having been performed since July 1861; but in several of the rural parishes, especially where the contractors' exertions have been aided by the clergy, the results have been very favourable. Thus in Fringford and Stratton Audley, where the schools were visited, 21 per thousand of the population have been vaccinated, and only two unprotected children were seen. In the adjoining district of Stoke Lyne (V.R. 16·5) the contractor has also attended regularly at his station, and states that in two years he has vaccinated 16 persons in a population of 2,174. Vaccination had been performed with regularity by his predecessor, to whose activity the relatively high rate is referable.

Stoke Lyne (Bicester).

Heyford (Bicester).

In the district of Heyford (V.R. 0·6), adjoining those of Bicester and Stoke Lyne, the same arrangements are in operation. During the four years following the passing of the Vaccination Act, 238 persons were vaccinated on various occasions in the parishes of Fritwell, Souldern, and Heyford, when the contractor obtained the assistance of the clergy or other persons locally interested in the welfare of the people, but no vaccinations have taken place since. In the town of Deddington (population 2,024, V.R. 2·0; 145 children examined, 44 per cent. of the elder children, and 65 per cent. of the infants unprotected), in which the contractor for Heyford resides, attendance is given weekly at the surgery. He estimates that there are about 300 children unvaccinated in the town, and attributes this state of things to the absence of any supervision either on his own part or that of the guardians.

Deddington (Woodstock).

Wycombe.

In the town of Wycombe, including the district immediately surrounding it (population 8,275, V.R. 10·8; 200 children examined, 26·5 per cent. unprotected) four contractors are resident, all of whom are said to vaccinate more or less at their surgeries. One of them, who vaccinates more than 3 times as many persons as the district officer, "looks up" his cases from house to house. With this exception, no supervision is exercised by the contractors or registrar.

Districts in which the performance of vaccination is strictly domiciliary.

In 48 districts the contractor visits from house to house for the purpose of vaccination; in 12 of these he vaccinates on the spot, taking no means to assemble the children for the purpose. In 36 he appoints meetings in parents' cottages. It is obvious that this distinction, although important, is not capable of strict application, for the varieties of practice in this respect necessarily merge into each other. While with one contractor the arrangement of cottage meetings is the rule, with another it is the exception.

In the districts in which no cottage meetings are held, the mean of the vaccination rates is 19·9, and of the infantile vaccination rates is 12·1.

Wendover (Wycombe).

In Wendover district (V.R. 31·3, I.V.R. 19·8; 97 children examined, 8·2 per cent. unprotected) the quantity of vaccination is large, but in

Hambledon (Henley).

Brill (Thame).

Aston Clinton (Aylesbury).

consequence of its bad quality (the scars being often scarcely recognizable) many of the school children were registered as unprotected. The contractor's numerical success is due to his long and intimate acquaintance with the population of his district. Although lists are not furnished by the registrar, that officer is in constant relation with the contractor. In Hambledon district (V.R. 24·7, I V.R. 22·3 ; 92 children examined, 11·9 unprotected) the high rates are referable to the same cause. In Brill district (V.R. 27·6, I.V.R. 3·0 ; 103 examined, 29·1 per cent. unprotected) vaccination is very irregularly carried out, being often discontinued for long periods of time. In the vaccination of arrears the contractor visits from house to house, vaccinating on the spot. Many children registered as unprotected had probably been vaccinated. In the district of Aston Clinton (V.R. 14·1, I.V.R. 4·4 ; 79 children examined, 16·5 unprotected) as in that of Brill, the contractor makes from time to time a universal house to house visitation of his parishes, vaccinating all the children. This operation affords occupation for an unqualified assistant at periods when there is less than usual district work of other kinds, especially in summer. It occasionally happens that no vaccination is performed for very long periods. From the results observed in this group of districts, it is apparent that the practice which distinguishes them not only leads to the constant employment of preserved lymph, but is usually associated with general carelessness in the discharge of the contractors' obligations, as evidenced by long periods of neglect, the vaccination of persons far above the age that is most advantageous for the purpose, and the employment of unqualified assistants.

The practice of vaccinating at the residence of each patient to be vaccinated is usually associated with the worst kind of vaccination.

Districts in which the children are assembled at places and times arranged on each occasion by the contractor.

In the 36 districts in which cottage meetings are held, the mean of the vaccination rates is 25·2, and of the infantile rates is 16·1.

Chipping Warden (Banbury).

Mortimer (Bradfield).

In the district of Chipping Warden (V. R. 31·2 ; 65 children examined, all protected) vaccination is carried out with singular regularity. The contractor's register shows that 90 per cent. of those vaccinated are less than a year old, and that half of the remainder are under two. It may be stated with confidence that all the children in the district of fit age are vaccinated. In the district of Mortimer (V.R. 31·1, I.V.R. 24·1; 47 children examined, only one of whom was unprotected) the registrar fills up the vaccination notice with "Mr. Izod's surgery, Mortimer," desiring the parent to present it to the contractor before the infant is three months of age, who thereupon makes arrangements for the vaccination, the place and time being so determined as to suit the convenience of such other parents as have children requiring vaccination in the neighbourhood. The district of Great Bedwyn (V.R. 29·2, I.V.R. 28·3; 108 children examined, 5·5 unprotected) affords another example of the successful adoption of the same method. The contractor's register shows that in 100 entries, 99 were of children under one year, and that vaccination is distributed with remarkable equality in the several parishes comprised in the district. The contractor receives no assistance from the registrar, and employs no systematic means of supervision, most of the deliveries being performed by midwives. He attributes his success to his personal influence and his persevering efforts to teach the people the value of vaccination, against which they were formerly much prejudiced. In the district of Blewberry (V.R. 36·3, I.V.R. 26·8 ; 72 children examined, 2·7 per cent unprotected) the arrangements are similar, with the exception that in two of the villages most of the meetings are fixed at the contractor's surgery. His register shows that 88 per cent. of the entries are of children below one year of age, and all of the rest under five years. The four preceding examples show conclusively that by the system of cottage meetings it is perfectly possible to render the

Great Bedwyn (Hungerford).

Blewberry (Wantage).

Excellent results observed in certain districts in which cottage meetings are held.

vaccination of a district numerically complete, to vaccinate almost all the children during the first year of life, and to afford to the people the very best kind of vaccination.

Districts in which lists of unvaccinated children are periodically, or from time to time, furnished to the contractor by the registrar.

Charlbury (Chipping Norton).

In 14 districts in which lists are furnished by the registrar of children requiring vaccination, the mean of the vaccination rates is 29·8, of the infantile vaccination rates 21·4. In Cropredy district (V.R. 33·7, I.V.R. 25·1; 208 children examined, 9·1 per cent. unprotected) the contractor, guided by the registrar's list (in which the entries are classified according to the parishes in which the parents reside), visits from house to house, vaccinating on the spot. It is obvious that in following this plan it is impossible for him to vaccinate from arm to arm; he therefore uses dry lymph which is carefully preserved in corked bottles, and never used when more than a week old. In the adjoining districts of Charlbury (V.R. 23·7, I.V.R. 19·5; 147 children examined, 2·7 unprotected) and Woodstock No. 2 (V.R. 31·9, I.V.R. 30·9; 215 children examined, 6·5 unprotected), the arrangements are the same, with the exception that in the former their operation is confined to part of the district. The register shows that 98 per cent. of the children are vaccinated before the completion of the fifth year of life, and that in those parishes which are included in the Charlbury registration district the total number of vaccinations is at least equal to that of the births. Both of these contractors use dry lymph largely, taking care to charge their points thickly, and to preserve them air-tight. The character of the cicatrices as seen in the schools was remarkably good, more than half of the children seen exhibiting a plurality of typical scars.

Hornton (Banbury).

Hendred (Wantage).

Sonning (Wokingham).

Whitchurch (Aylesbury).

Risborough (Wycombe).

In the district of Hornton (V.R. 30·3, I.V.R. 23·6; 92 children examined, 3·2 per cent. unprotected), the contractor holds yearly vaccinations in all his villages, a plan to which the only drawback consists in its leading to postponement. The register shows that nearly all of the children were vaccinated before completing their fifth year. In Hendred district (V.R. 38·6, I.V.R. 28·7; 79 children examined, 6·3 per cent. unprotected), the register shows that during the last few years all the children born must have been vaccinated, and that in addition many arrears were made up. In Sonning district (V.R. 32·8, I.V.R. 24.1; 81 children examined, 11.5 per cent. unprotected), the children are assembled in the school-rooms, the contractor making a previous house to house visitation by the list. In Whitchurch district (V.R. 48·7, I.V.R. 31·5; 106 children examined, 19·8 unprotected), the method of lists has been adopted recently by the contractor, who has them prepared periodically by a clerk at his own expense. During the last three years all the infants have been vaccinated within twelve months of birth; but the large proportion of unvaccinated children seen in the schools indicates that there are still many arrears to be made up. In the district of Risborough (V.R. 31·6, I.V.R. 17·0; 71 children examined, 11·3 unprotected), the results appear not so satisfactory in respect of the age of those vaccinated, a defect which is due to irregularity in the practice of the contractor.

Faringdon Union.

In the union of Faringdon lists are furnished by the registrars to all of the contractors. In the Faringdon district (V.R. 27·8; 189 children examined, 4·2 per cent unprotected) the children resident in the town (population 3,400) are mostly vaccinated at the surgery, private arrangements being made for assembling them. The register shows that 96 per cent of those vaccinated had not attained the age of 12 months. In the district of Shrivenham, although lists have been furnished, the contractor did not avail himself of them until in December 1861 small-pox appeared in one of the villages, since which time 350 persons of all ages have been vaccinated in a population of 2,900.

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I. Local inquiries as to Vaccination.

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In ten districts the contractor attends for vaccination at stated places, but at times appointed according to his own convenience. The mean of the vaccination rates is 27·4, of the infantile vaccination rates 19·9.

Swalcliffe (Banbury).

Kidlington (Woodstock).

Aldermaston (Bradfield).

Cookham.

The contractor of Swalcliffe district (V.R. 31·5, I.V.R. 26·8; 116 children examined, 16·5 unprotected) appoints times for attendance at fixed places in the two largest villages, where he vaccinates from arm to arm. In the others he visits from house to house, using points for conveyance. I am unable to account for the discrepancy between the state of vaccination in the schools and the infantile rate. In Kidlington district (V.R. 27·7, I.V.R. 19·8; 148 children examined, 13·9 per cent. unprotected), times for stational vaccination are appointed occasionally, and announced by notices affixed to the church doors. From the low infantile rate and the large proportion of unvaccinated children observed in the infant classes in the school, it may be inferred that vaccination is habitually postponed. In Aldermaston district (V.R. 25·2, I.V.R. 22·3; 86 children examined, 8·1 per cent. unprotected) the contractor holds vaccinations regularly at intervals of two months, which he announces by private means, attending subsequently from week to week if necessary. In Cookham district (V.R. 48·3, of which 26·9 only arises from vaccinations performed in the district, I.V.R. 38·6; 115 children examined, 2·6 per cent. unprotected) meetings for vaccination are appointed by the contractor in the national schools, and announced by the schoolmasters. In addition to this arrangement he visits from house to house for the purpose of looking up cases.

Bradwell (Newport Pagnell).

Wantage.

In the important village of New Bradwell, inhabited by factory operatives, (V.R. 41·7, I.V.R. 24·4; 133 children examined, 8·3 per cent. unprotected,) the contractor of the district carries out the plan of stational appointments with great success. He holds a vaccination every quarter, particularly in spring and autumn, maintaining weekly vaccination on each occasion as long as there are applicants. The excessive rate is due to the performance of revaccinations in several of the villages, in consequence of the occurrence of a case of small-pox. In the district of Wantage (V.R. 13·2, I.V.R. 8·7; 86 children examined, 25·5 unprotected), the contractor appoints a vaccinating day about once in three months at most of the original stations, but no subsequent attendance is given. Vaccination is always performed with dry lymph carefully stored. The rates show that the plan fails entirely. In this union unusual efforts have been made by the guardians to give effect to the contract arrangements. Stations are maintained in every important village, in front of which notice boards are affixed, indicating the times and places fixed for attendance. In all the districts except Wantage they are entirely disused.

URBAN DISTRICTS.

In districts which form parts of considerable towns, having populations exceeding 5,000 (*e.g.* Oxford, Reading, Windsor, Aylesbury, Abingdon), the mean of the vaccination rates is 19·0, and the mean of the infantile vaccination rates is 11·7.

Public vaccination in Oxford.

The town of Oxford is comprised in two vaccination districts, one of which is identical with that of the Oxford Incorporation, and constitutes a single district both for registration and medical relief, while the other, consisting of the three parishes of St. Clement, St. Giles, and Saint John, forms part of the union of Headington and vaccination district of the same name. In the Oxford Incorporation district the annual number of public vaccinations during the five years terminating Michaelmas 1861 was 225, or 11·2 per thousand of the population; during the same period 1,945 persons were born, so that the

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vaccinations were to the births as 1 to 3. In the three parishes above named, having a population of 7,500, the annual number of vaccinations amounted to 91, or 12·5 per thousand, but no returns exist from which the births can be computed. The defect of vaccination which these numbers imply is shown to be in some measure made up by the activity of private vaccinators. The registrar received duplicate certificates from thirteen practitioners, whose vaccinations amounted, during the three years already referred to, to 280 annually. Of these 126 were contributed by one practitioner, while about 44 arose from the vaccinations gratuitously performed at the station of the National Vaccine Establishment; so that even if it be assumed that the actual number of vaccinations is represented by that of the duplicate certificates the vaccinations must have amounted to 88·5 per cent. of the births in 1859, and to 74·3 per cent. in 1860.

The defect indicated by the returns is in part supplied by private vaccination.

The public vaccinating station of Oxford is the surgery of the contractor; its situation is very central. Vaccination is carried on from week to week throughout the year, the usual weekly attendance varying from 3 in the winter to 6 or 7 in the summer. Since Michaelmas 1858, when the district which had previously been divided was consolidated, the average quarterly attendance at the station has been 52. During the nine quarters preceding Dec. 31st 1860, when a station was opened for gratuitous vaccination by the National Establishment, the average attendance was 62; subsequently it has not exceeded 38·5. This diminution is not attributable to the gratuitous vaccination at this station of persons who would otherwise have applied to the contractor, (for it is more than twice as great as the whole number of those so vaccinated) but rather to its interference with the general working of the public station. It illustrates the principle that the division of stations acts injuriously on the quantity of vaccination in towns.

Weekly vaccination is maintained throughout the year at the station.

The attendance of applicants has diminished since the end of the year 1860.

The registration of vaccination is also carried out in Oxford in a more effectual and regular manner than in most other towns, the registrar having made great efforts to induce the medical practitioners to transmit to him their duplicate certificates. With this view as well as for the general promotion of vaccination he has issued in a large number of cases compulsory notices requiring immediate compliance with the Vaccination Act, and has also furnished "lists" to the public vaccinator of persons neglecting to have their children vaccinated. Five years ago he laid informations in five cases of default; no convictions were obtained in consequence of the interference of certain medical practitioners in the town; one of them, who was himself a public vaccinator, furnished the defendants with certificates of unfitness. In consequence of the opposition which the registrar met with he appears to have relaxed his exertions. Compulsory notices have also been issued in the Headington district but no prosecutions have taken place.

Efficient performance of the duties of registrar.

The state of the schools in Oxford (525 children examined, of whom 11·8 per cent. unprotected) leads to the conclusion that among the poor vaccination is much neglected, notwithstanding the facilities which are offered, showing that such facilities are of little value unless means be at the same time taken to see that the people actually avail themselves of them.

The town of Reading, which forms a union by itself, is divided into three districts, both for vaccination and for registration. Three vaccinating stations are maintained, which are the surgeries of the three medical officers; they are all in central situations, but are not more accessible to the districts to which they belong than to the rest of the town. During the three years ending Michaelmas 1861, the annual numbers of births in the three districts were, St. Giles 330, St. Lawrence

Vaccination in Reading.

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155, and St. Mary 347; in the whole union the number was 832, so that the three stations might be consolidated with advantage, so far as relates to the maintenance of continuous vaccination. The following Table exhibits the actual number of vaccinations that have been performed in each district since the passing of the Vaccination Act.

——	St. Giles.	St. Lawrence.	St. Mary.
Half-year ending Michaelmas 1854 - -	131	67	120
Year ,, ,, 1855 - -	168	75	154
,, ,, ,, 1856 - -	124	39	123
,, ,, ,, 1857 - -	115	52	162
,, ,, ,, 1858 - -	165	53	125
,, ,, ,, 1859 - -	442	150	498
,, ,, ,, 1860 - -	206	82	372
,, ,, ,, 1861 - -	239	65	206

Increase of vaccination in 1859;

due to the occurrence of cases of small-pox in the town.

From the above Table it appears that the annual numbers of vaccinations performed during and after 1859 were not only absolutely, but relatively much greater than those of the preceding years. In the four years, 1855–58, the populations of the three districts (assuming the rate of increase to have been unvarying), being severally, St. Giles 9,374, St. Lawrence 4,661, and St. Mary 10,094, the vaccinations constituted 15·3 per thousand of the population in St. Giles, 11·8 in St. Lawrence, and 13·8 in St. Mary, while, during the succeeding years, the average rates per thousand were, St. Giles 29·0, St. Lawrence 20·9, and St. Mary 32·7. These high proportions were mainly due to the year 1859, when the vaccinations exceeded the births by 131 in St. Giles, and 186 in St. Mary. The cause of this sudden increase is to be found in the occurrence in the town, in January, February, and March 1859, of several cases of small-pox, six of which were fatal. During the first quarter of the year, 269 persons applied at the St. Giles' station for vaccination, and 226 at the St. Mary's station. In the month of March the applicants at the former numbered 170, the attendance on one day amounting to 37. Of those who were vaccinated at this period, only three per cent. were adults, most of the patients being children between 1 and 12 years of age. Small-pox cases occurred from time to time in Reading until the end of the year, but no deaths appear in the register after April. In January 1860 the attention of the guardians was called to the prevalence of the disease, who directed the registrars to report on the subject. On receiving from those officers a list of 94 children in respect of whose vaccinations they had not received duplicate certificates, the guardians directed that compulsory notices should be issued. These having been complied with in all excepting seven instances, the clerk was instructed to lay informations against the parties in default. On the hearing, six of the cases were dismissed, the parents or guardians producing in court certificates of previous vaccination. In the other case, the defendant was convicted, and a mitigated penalty was imposed.

Vaccination is performed with great regularity at two of the stations.

At the present time vaccination is performed with great regularity at two of the stations; at that of St. Mary the weekly attendance varied during the past year from 2 in January and February to 6 or 7 in July, and in St. Giles from 2 in November to 6 in May and June. No domiciliary vaccination is performed. As compared with that of other towns, the state of protection of Reading may be regarded as satisfactory. If we may assume that for every three public vaccinations one was performed by private practitioners (an assumption justified by experience), the annual number falls little short of what it would be if all the children of fit age were vaccinated.

Neglect of vaccination in Windsor.

Windsor and Eton may be regarded as one town as regards vaccination, for the two districts, although in different unions, are worked as one, having been for some time past held by the same firm, though nominally by different practitioners. Vaccination is performed weekly at the surgery of the contractors in Windsor, at which most of the poor who reside in Eton attend for the purpose. Here, as at Reading many years' neglect of vaccination was brought to light by an invasion of small-pox. During the two years ending Michaelmas 1860, 423 persons were vaccinated in Windsor, and 106 in Eton, giving an annual vaccination rate of 16·9 in the former, and 16·1 in the latter. In January 1861 a tramp from a neighbouring town, suffering from small-pox, applied for relief at the Windsor dispensary, where he came into relation with a number of persons in the waiting-room. Thereupon the disease spread with considerable rapidity. The deaths amounted to 19, of which 3 occurred in the first quarter, 5 in the second, 3 in the third, and 8 in the fourth. During the prevalence of small-pox vaccination received an extraordinary impulse ; in the three months of its greatest prevalence (May, June, and July 1861) 54, 241, and 71 persons were severally vaccinated, and on one day, June 17th, there were no less than 54 applicants at the surgery. Of those vaccinated at this period nearly half were above 12 years of age, and most of the rest above 5, from which circumstance it may be inferred that vaccination had been postponed in a larger proportion of cases in Windsor than in Reading. In the schools in Eton scarcely any unprotected children were found, but in Windsor of 425 children seen in the schools 9·4 per cent. were without marks of vaccination, so that it is to be apprehended that in case of a fresh invasion of small-pox the town would again be liable to its diffusion.

Invasion of small-pox.

Mortality from that disease in 1861.

Notwithstanding the great increase of vaccination during that year, the state of protection of the population is very unsatisfactory.

Aylesbury.

In Aylesbury vaccination is conducted on the same plan as at Reading, Oxford, and Windsor. No proceedings have been taken by the guardians in furtherance of vaccination, but the subject has been otherwise brought under public notice. In the whole district about 19 per thousand of the population are annually vaccinated ; no returns exist by which it can be ascertained how many of these cases are referable to the town. Fifteen per cent. of the children in the schools were found to be unprotected, and the contractor himself expresses no doubt that a large proportion of the children are unvaccinated.

Complete failure of public vaccination in Abingdon.

The state of public vaccination in the town of Abingdon contrasts very unfavourably with that of any of the towns hitherto referred to. In a population of 7,172, 173 vaccinations have been performed in three years by the public vaccinators, viz., 7·7 per thousand annually, and of these one third have been of persons above the age of one year. Of 315 children seen in the schools 28·5 per cent. were without scars. When it is further considered that scarcely any vaccinations are performed by other practitioners than the public vaccinators, it is obvious that the town is in an extremely unprotected state. The antipathy of the people to vaccination is said to be extraordinary, and to have sensibly increased during the last few years. It is attributed by one of the vaccinators to the unfavourable influence exercised on the poor by the almost universal occupation of the women in the slop factories, and to that general indifference to the welfare of their offspring which so frequently characterizes mothers employed in this manner. In the years 1854 and 1855 small-pox prevailed very extensively in the town, proving fatal to 21 persons, but this outbreak does not seem to have awakened the people to the necessity of vaccination.

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IV. QUALITY OF VACCINATION.

TABLE III.—SHOWING the NUMBER of CHILDREN EXAMINED in each of 28 UNIONS, and the NUMBER and QUALITY of the CICATRICES of VACCINATION.

Name of Union.	Total.	None.	Doubtful.	Typical.				Passable.				Bad.				With Marks of Small-pox.					
				4.	3.	2.	1.	4.	3.	2.	1.	4.	3.	2.	1.	4.	3.	2.	1.	None	Doubtful.
Banbury - - -	1,077	139	19	44	124	236	155	14	42	164	79	4	7	20	30	—	1	2	2	3	1
Bicester - - -	560	119	7	11	92	93	66	—	28	70	47	—	2	11	14	—	—	—	1	1	—
Chipping Norton -	646	72	15	29	80	97	62	26	64	89	55	1	12	24	20	—	—	—	—	—	1
Headington - -	380	61	7	16	39	56	44	8	30	55	35	—	4	10	15	—	—	—	—	1	—
Henley - - -	623	70	12	43	73	119	76	11	33	75	58	—	9	19	25	—	—	—	—	2	—
Oxford - - -	358	39	8	49	43	56	37	15	36	35	21	1	3	8	7	—	—	—	1	—	—
Thame - - -	597	89	14	23	56	146	80	6	26	84	42	2	4	14	11	—	—	—	—	3	—
Witney - - -	583	62	15	22	39	98	59	32	51	88	81	2	6	10	18	—	—	—	—	—	—
Woodstock - - -	830	138	17	52	113	167	130	9	45	82	45	—	5	8	19	—	—	—	—	2	—
Abingdon- - -	701	110	16	13	72	174	90	3	18	98	45	1	8	24	29	—	—	—	—	3	—
Bradfield - - -	424	16	4	9	37	74	64	6	26	73	71	—	5	20	19	—	—	—	—	—	—
Cookham - - -	438	52	7	18	39	51	46	24	41	74	41	3	8	8	26	—	—	—	—	3	—
Easthampstead - -	508	20	10	58	64	91	58	30	44	69	34	2	6	10	12	—	—	—	—	—	—
Faringdon - - -	616	24	5	7	22	195	112	10	21	108	59	—	5	21	27	—	—	—	—	—	—
Hungerford - -	494	39	13	21	82	99	41	3	31	88	33	1	8	15	20	—	—	—	—	—	—
Newbury - - -	483	62	12	33	38	72	42	18	50	53	39	7	7	18	32	—	—	—	1	—	—
Reading - - -	921	59	13	73	172	175	90	23	100	122	38	5	17	17	17	—	—	1	—	11	—
Wallingford - -	474	48	16	13	54	61	35	30	48	66	35	6	12	19	31	—	—	—	—	—	—
Wantage - - -	355	35	3	3	20	61	75	4	35	46	36	—	6	13	18	—	—	—	—	—	1
Windsor - - -	649	63	7	103	84	116	57	46	37	69	29	3	10	16	9	—	—	—	3	9	—
Wokingham - -	488	31	7	54	45	81	73	22	33	47	64	2	3	12	14	—	—	—	—	4	—
Amersham - - -	580	121	8	12	35	67	46	12	38	88	66	6	11	18	52	—	—	—	—	—	—
Aylesbury - - -	751	101	4	179	99	94	49	27	40	83	42	3	4	14	12	—	—	—	—	—	—
Buckingham - -	482	89	7	13	84	93	56	4	39	53	25	1	6	5	7	—	—	—	—	2	—
Eton - - - -	665	50	8	63	86	88	58	31	66	79	64	3	20	30	19	—	—	—	—	—	—
Newport Pagnell -	924	132	10	28	36	170	216	11	42	132	100	3	1	12	31	—	—	1	—	4	2
Winslow - - -	177	25	4	11	18	27	15	6	18	20	6	4	7	12	4	—	—	—	—	—	—
Wycombe - - -	886	140	11	20	41	100	83	44	84	162	92	4	13	32	60	—	—	—	—	2	—
Totals - -	16,670	2,006	279	1,020	1,787	2,957	2,015	475	1,166	2,272	1,382	64	209	440	598	—	1	4	8	50	5

The inspection of vaccine scars affords a reliable test of the quality of vaccination, for scars produced by the same method always exhibit similar appearances.

Although the quality of vaccination can be judged of with certainty only by the observation of the arm during the progress of the vaccine disease, yet, when this is not possible, the examination of the scars in a sufficient number of children known to have been vaccinated by one operator affords satisfactory ground for stating, either that the operation has in general been performed in an effectual manner, or the contrary. Those who found their opinion on casual observation only, are apt to imagine that the character of the vaccine scar is so variable, and so liable to disappear in the course of time, that an opinion formed in this way must be worthless. Experience, however, teaches that the variety of aspect which is presented by the mark of vaccination is not at all accidental, but results from the endless variety of the methods which are in use among practitioners, and that the scars which are the work of one hand, and produced by the same method, present so constant a uniformity of aspect that it is easy, after an inspection of a sufficient number, to sketch or describe their prevailing characters.

From these appearances the method of insertion and the characters of the resulting vesicle may be inferred; and by comparing them with those produced by the best kind of vaccination, the protective value of the operation may be judged of.

In some cases the comparison is difficult.

To the practised eye the vaccine scar reveals the origin and nature of the process which has produced it. As regards the mode of operation, it tells whether the vaccine lymph has been inserted by puncture or abrasion, whether the instrument has been merely introduced below the epidermis or has penetrated the cutis, whether the vesicle has been surrounded by induration, whether it has been multiple or single, &c. The value of these indications must be judged of by comparing them with those of the normal progress and development of the typical vaccine vesicle, as exhibited in children who have been vaccinated by careful operators. Occasionally the application of this method of comparison is difficult or impossible, for in some cases anomalies are observed of the mode of production of which there is no means of judging, so that although there can be no doubt that they imply a less perfect vaccination than normal scars, it is not possible to assign to them their precise protective value.

Method of recording the results of the examination of schools; tabular registration of scars.

Meaning of the terms good, passable, and bad.

In accordance with the plan adopted in previous inquiries, the results of the examination of each child was registered according to the supposed protective value of the scars, as typical, passable, or bad. In order to render my tables more comparable, I determined at the outset to assign the following definite meanings to the terms employed. As in my former report, I have recorded under the heading "bad," scars which exhibited no appearances from which it could be inferred that they were products of vaccination, and were only recognized as such by their position and arrangement. Those marks, which were so characteristic that one might have pronounced upon their nature in whatever part of the body they had been found, have been recorded as "passable" or "typical." I have adopted *area* as the ground of distinction between these two last terms, considering that it is not only an element of great importance, but one which can be easily judged of. Having learnt from my previous observations that the normal area of a well developed vaccine vesicle seldom falls short of a tenth of a square inch, or, as it is roughly expressed, the size of a large pea, I have recorded all *characteristic* cicatrices having an area equal to this or larger, as typical, the rest as passable.

The prevailing appearances of the cicatrices of vaccination in each school were separately noted.

In the course of my examination of schools, I have noted marginally the appearances of the scars observed in individual children ascertained by personal inquiry to have been vaccinated by the contractor of the district. On these notes I have founded a general description of the prevailing character of his results, with respect to area, contour, form of surface (depressed or elevated, pitted, smooth, or glazy), and colour (pale or livid).

The degree of protection of any number of vaccinated children examined may be conveniently expressed by the proportion of cases in which a plurality of typical scars, or any number of bad scars, are discovered.

Assuming that the protective value of vaccination varies with the number and area of the scars and with the conformity of their characters to the typical standard, the state of protection of any number of vaccinated children examined may be judged of by the relative frequency with which numerous full-sized typical scars are observed, and by the rarity of bad scars. In the present inquiry I have applied this criterion to all (except one) of the districts visited. I have estimated the number per cent. of the scarred children seen in each district who exhibited (*a*) a plurality of typical marks, indicating good protection; or (*b*) one passable or any number of bad marks, indicating bad protection; the remainder consisting of those in whom a single typical mark or a plurality of passable marks were recorded. Estimated in this manner, the average state of protection of the vaccinated children seen in the course of the whole inquiry is represented by the following per-centages :—

Among 14,385 children in whom marks of vaccination were found the protection was - -	Good in - 40·070 per cent.
	Middling in 41·223 ,,
	Bad in - 18·707 ,,

Of the whole number of scarred children seen in each district, the proportions per cent. of children in whom a plurality of typical scars were observed (per-centages of good protection) are exhibited in the following Table, showing the number of districts in which various per-centages of good protection prevailed in the schools :—

Per-centages of good protection.

In 3 districts the per-centage of good protection was from	70 to 80
,, 9 ,, ,, ,, ,,	60 ,, 70
,, 18 ,, ,, ,, ,,	50 ,, 60
,, 21 ,, ,, ,, ,,	40 ,, 50
,, 38 ,, ,, ,, ,,	30 ,, 40
,, 21 ,, ,, ,, ,,	20 ,, 30
,, 16 ,, ,, ,, ,,	10 ,, 20
,, 1 ,, ,, ,, ,,	0 ,, 10

The corresponding per-centages of children in whom a single passable scar or any number of bad scars were observed are as under :— Table showing the number of districts in which various per-centages of bad protection were recorded :—

Per-centages of bad protection.

In 5 districts the per-centage of bad protection was from	0 to 5
,, 18 ,, ,, ,, ,,	5 ,, 10
,, 46 ,, ,, ,, ,,	10 ,, 20
,, 37 ,, ,, ,, ,,	20 ,, 30
,, 15 ,, ,, ,, ,,	30 ,, 40
,, 5 ,, ,, ,, ,,	40 ,, 50
,, 1* ,, ,, ,, ,,	50 and upwards.

In the following paragraphs I propose to refer in succession to each of the districts visited by me, which was remarkable either for the good or bad quality of its vaccination as indicated by the registration of scars seen in the schools. In selecting these examples I have been guided in the first place by the relative number of well and of imperfectly protected children ; and, secondly, by the area and character of the cicatrices, as recorded in my notes. At the commencement of

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* In the above Tables 127 districts only are referred to for the following reasons :— The 136 districts comprised in Table II. being held by 129 contractors, may be considered with reference to quality of vaccination as 129 districts. Two of these are omitted, because in one there was no school, in the other the contractor had recently resigned and his successor had not been appointed.

the paragraph relating to each district the number of children seen in the schools, the predominant number of cicatrices (that is, the number most frequently observed in one child), and the per-centages, decimals being omitted for the sake of brevity, of good and bad protection are stated in brackets. The area is expressed in per-centages of a square-inch.

Districts in which the best results were observed.

The following districts claim to be regarded as the best vaccinated, on the double ground of high per-centage of good scars and low per-centage of bad ones. Aylesbury, Chipping Warden, Egham, Eton, Abingdon No. 1, Woodstock No. 2, Great Bedwyn, Bracknell, Swalcliffe, Bampton No. 2.

Aylesbury (Aylesbury).

Aylesbury (339 children examined ; predominant number 4 or more ; protection per-centages, good 77, bad 5). The Aylesbury vaccination district includes the town and three rural parishes ; four schools were visited one of which was rural. Of the whole number of scarred children 54 per cent. had 4 or a greater number of scars; the total number of scars registered was 945, so that the mean number on each child was 3·3. Of the most typical cicatrices the area was about a quarter of a square inch (25″), so that the total area of scar on each child was 83″. This area far exceeded that recorded in any other district. From approximative measurements made in other well vaccinated schools, I believe that the average area of scars registered as typical is about 12″. Of the children examined in all the schools visited who exhibited such scars (7,779) the average number possessed by each was 2·26, hence the mean area of scar for each child was 27″, or a little more than a fourth of the area possessed by the children at Aylesbury.

At Aylesbury the total area of cicatrix on each child was greater than in any other district.

The scars seen in the Aylesbury district are oval; they have no abrupt or indented margin, and their general surface is beset in all parts with numerous but distinct pits, but is not depressed below that of the surrounding skin. In a certain number of children scars of a different character are observed ; these have the same area as the others, but are smooth and depressed with indented margins; they often exhibit faint wrinkles radiating from their somewhat elevated centres. Lymph is usually inserted by four parallel scratches produced by Dr. Weir's vaccinator. Vaccination is performed either from arm to arm or with liquid lymph stored in capillary tubes.—Chipping Warden (65 children examined ; predominant number 3 ; protection per-centages, good 77, bad 0). The area of the scars scarcely exceeds the minimum (10″), so that although numerically the district stands high, the protective value of the vaccination is in fact very far inferior to that of many districts having lower numbers. Vaccination is usually performed directly by a single superficial puncture for each intended vesicle.—Egham (81 children examined ; predominant number, 3 ; protection per-centages good 76, bad 7.) The area of the scars is nearly equal to that recorded at Aylesbury, and their general character is similar. Most of the vaccinations are performed on application at the stations, lymph being inserted by numerous minute punctures dispersed over the area of the intended vesicle.—Windsor and Eton (number of children examined, 532 ; predominant number, 4 ; per-centages in schools at Eton, good 69, bad 3 ; at Windsor, good 51, bad 11). At Windsor the elder children were vaccinated by the father of the present contractor, whose method of insertion consisted in making numerous scratches for each intended vesicle, while the infants were vaccinated by his son, who inserts by puncture. The scars seen among the former were large, characteristic, and of regular contour, contrasting in all these respects with those of the infants. Almost all of the children are vaccinated at the public station, where arm to arm vaccination

The scars occasionally exhibit indications of excessive local action.

Chipping Warden (Banbury).

Egham (Windsor).

Windsor and Eton.

Kidlington (Woodstock).

Woodstock, No. 2.

Great Bedwyn (Hungerford).

Bampton, No. 2 (Witney).

is for the most part maintained.—Kidlington (number of children examined, 148; predominant number, 2; protection per-centages, good 65, bad 3). The area of the scars is small (7″) and their contour irregular. Most of them are oval, often exhibiting a central elevation surrounded by an annular furrow. The contractor inserts by a single scratch for each intended vesicle. The register shows that most of the vaccinations must be performed from arm to arm.—Woodstock, No. 2 (number of children examined, 215; predominant number, 2; protection per-centages, good 55, bad 8.) The contractor vaccinates from house to house, rarely assembling the children. When dry lymph is employed it is never kept more than seven days, and is carefully preserved in stoppered bottles. Lymph is inserted by Dr. Weir's vaccinator. The scars have an area of 20″; they are usually oval, but often irregular or lozenge shaped, and in many instances excavated and wrinkled cicatrices with indented margins are observed. In the district of Great Bedwyn (number of children examined, 108; predominant number 2, protection per-centages, good 64, bad 8) the scars are circular or oval, of uniform character, but their area does not exceed 12″. The defect of size arises from the mode of insertion, which is by puncture. The contractor's arrangements are such as to enable him to vaccinate exclusively from arm to arm. Bampton, No. 2 (number of children examined, 78; predominant number, 2; protection per-centages, good 57, bad 7). The scars are oval and uniformly pitted; they exhibit neither elevated centres nor indented margins: area large, 30″–35″. The contractor inserts by the process of *tattooing*, first covering the skin to the extent of the intended vesication with moist lymph, then "working it in" with the point of Spratley's vaccinating needle, kept very sharp; his arrangements are such as to secure direct vaccination in most cases.

Districts which are entitled to be regarded as well vaccinated, although the per-centages of good results observed in the schools were considerably below the maximum.

The following districts, although their per-centages of good results were insufficient to distinguish them as being well vaccinated, acquire a title to this character by virtue of the unusual area of the scars:—Oxford (number of children examined, 358; predominant number, 2; protection per-centages, good 47, bad 13). The visitation of the schools in Oxford afforded no opportunity of investigating the quality of the contractor's work, which was judged of entirely by the observation of children known to have been vaccinated by him. Vaccination is almost exclusively performed at the contractor's, Mr. C. J. Vincent's, surgery. For some years past he has recorded in respect of every vaccination performed by him, whether public or private, the date and mode of vaccination, the date of vaccination of the vaccinifer, the mode in which the lymph was preserved, and the results of the operation. He was kind enough not only to furnish me with several tabular statements containing important information relating to those matters, but to place his private register at my disposal. Mr. Vincent employs two methods of vaccination. In vaccinating from arm to arm he punctures in the usual manner with a grooved vaccinating lancet. In using dry lymph two or three parallel straight scratches are made for each insertion. By the former method (puncture) a vesicle is produced, of which the cicatrix has usually an area of from 7″ to 10″. When the latter is employed the area of the scar varies from 12″ to 16″. The general aspects of the scars were uniform. Most of them were somewhat elevated and glazy in the centre, and exhibited a marginal annular depression beset with pits, but in the smaller examples these characters were less observable, the whole area being more uniformly pitted. The relative success of the two methods may be accurately judged of from the following facts, extracted by myself from Mr. Vincent's private register.

I. Local inquiries as to Vaccination.

3. Oxfordshire, Berkshire, and Buckinghamshire, by Dr. Sanderson.

Comparison of the results of arm to arm vaccination with those of vaccination with dry lymph.

In 100 cases of arm to arm vaccination performed continuously between April 1st 1860 and April 22nd 1861 all were successful. Of 100 cases of vaccination with dry lymph, stored in stoppered bottles for periods rarely exceeding 3 weeks, 3 were unsuccessful. Of the first 100 (direct vaccination), 46 were vaccinated by 4 insertions, and 54 by 3 insertions. Of the vaccinations by 4 insertions, 41 resulted in 4 vesicles, 3 in 3 vesicles, and 2 in 2 vesicles. Of the vaccinations by 3 insertions, 51 resulted in 3 vesicles, 2 in 2 vesicles, and 1 in 1 vesicle. Or, otherwise stated, 346 insertions produced 335 vesicles, so that 97·0 per cent. were productive. Of the second 100 (vaccination with dry lymph), 40 were vaccinated by 4 insertions, and 60 by 3 insertions. Of the vaccinations by 4 insertions, 27 resulted in 4 vesicles, 10 in 3 vesicles, 2 in 2 vesicles, and one was unsuccessful; of the vaccinations by 3 insertions, 53 resulted in 3 vesicles, 5 in 2 vesicles, and 2 were unsuccessful; or in other words, 340 insertions produced 311 vesicles, or 91·2 per cent. It thus appeared not only that entire failure occurred more frequently in the second series of cases, but that a larger proportion of the insertions in each case proved abortive.

Results of the employment of dry lymph stored for long periods.

Mr. Vincent has also furnished me with a return showing the results of 24 vaccinations performed by him with dry lymph, which had been kept for periods varing from 8 weeks to 18 months. When lymph was used between 8 and 15 weeks after it was taken, 2 vaccinations failed in 11, and 23 vesicles were obtained from 34 insertions. When lymph kept from 15 to 20 weeks was used, 15 scars resulted from 25 insertions, and 3 vaccinations failed. Of three vaccinations with lymph kept 11 months, 2 were unsuccessful, while the other produced only one vesicle; a single case in which lymph kept for 18 months was employed was also unsuccessful. The whole series gave 8 failures, 76 insertions producing 43 vesicles, thus showing that although recent dry lymph could be used almost as successfully as if taken directly from the arm, this was not the case when it had been kept for long periods.

Middleton (Banbury).

Deddington (Woodstock).

Whitchurch (Aylesbury).

Buckingham.

Middleton Cheney (number of children examined 111; predominant number, 2; protection per-centages, good 46, bad 7). The scars are uniformly pitted and elliptical, the greater diameter of the ellipse coinciding in direction with the axis of the limb: area 20″. They are produced by a long valvular scarification, lymph being usually inserted from arm to arm.—Deddington, No. 2 (59 children examined; predominant numbers, 1 and 2; protection per-centages, good 43, bad 8). The scars are large, characteristic, and closely resemble those observed in the district of Bampton, No. 2: area 28″ to 30″. The contractor vaccinates from house to house usually with dry lymph kept from a week to 10 days in a corked bottle, and inserts with Dr. Weir's vaccinator.—Whitchurch (number of children examined, 106; predominant number, 3; protection per-centages, good 46, bad 13). The contractor inserts by numerous minute contiguous scratches, the lymph employed being usually stored on thickly charged points, which are occasionally kept for several months in corked bottles. The scars are oval, of regular form and appearance; area 12″ to 14″.—Buckingham (number of children examined, 199; predominant number, 2; protection per-centages, good 42, bad 16). The scars are peculiar and characteristic; they consist of an aggregate of 4, 5, or 6 ordinary circular cicatrices confluent by their margins, and are produced by a varying number of parallel scratches at the distances of 3-10ths of an inch from each other. As each circle has an area of about 7″, the whole batch occupies a space of 28″ to 35″. Cottage or schoolroom meetings for vaccination are held by private arrangement, at which arm to arm

APPENDIX.

I. Local inquiries as to Vaccination.

3. Oxfordshire, Berkshire, and Buckinghamshire, by Dr. Sanderson.

Iver (Eton).

Crawley (Newport Pagnell).

Faringdon.

Reading.

vaccination is performed; lymph is stored in capillary tubes.—Iver (number of children examined, 99; predominant number, 3; protection per-centages, good 47, bad 16). The contractor vaccinates exclusively from arm to arm, arranging cottage meetings for the purpose. He inserts by several scratches for each intended vesicle made with a blunt lancet. The scars are remarkably characteristic, uniform, and equal.—Crawley (number of children examined, 57; predominant number, 1; protection per-centages, good 11, bad 9). The scars exhibit an unsatisfactory aspect, having raised centres with depressed, abrupt, and indented margins; area 16″–20″. Each of them is produced by two parallel scratches made with a dull lancet. Vaccination is mostly performed from arm to arm.—Faringdon (number of children examined, 189; predominant number, 2; protection per-centages, good 49, bad 8). Vaccination is performed almost exclusively from arm to arm by means of meetings privately arranged. Lymph is inserted by puncture, and the aspect of the scars is notably typical; area 18″–20″.—Reading (number of children examined, 921; predominant number, 2; protection per-centages, good 49, bad 11). At Reading, as in other large towns, great variety was observable in the results of vaccination, so that the per-centages are inapplicable as tests of quality; but in the districts of St. Giles and St. Mary, whenever children could be met with known to have been publicly vaccinated, the scars were found to be large (area 12″–16″) oval and uniformly pitted. Most of the vaccination is performed from arm to arm, either by abrasion or epidermal puncture. When the latter method was employed, 20 failures occurred in 234 vaccinations.

Influence of the mode of insertion on the area and character of the scar.

"Tattooing."

"Scarification."

Dr. Weir's vaccinator.

Puncture.

The preceding examples illustrate the effect of various modes of insertion on the size and character of the scars. It is observable that the largest and most characteristic cicatrices are produced when those methods are employed by which vaccine is brought most extensively into contact with the cutis. On the whole, the best results appear to be obtained by a process which consists of penetrating the epidermis after smearing it with liquid lymph over a surface corresponding to that of the intended vesicle by a number of minute punctures, or rather pricks. If carefully done with a sharp instrument held like a pen and without crossing, insertion by scratching or scarification is equally advantageous. But if a blunt lancet, or an instrument similar to the vaccinator of Dr. Weir, is employed, there seems to be no doubt that scars of the character described on p. 69 are apt to be produced. In these scars the sinking of the cicatricial surface and its glazy and wrinkled aspect show that something more than vesication has been produced, and that tissues deeper than the epidermis have been involved. As regards vaccination by puncture, the scars vary in area not so much according to the depth of the puncture as according to the extent of cuticle separated by the lancet from the subjacent vascular tissue. When each insertion is made by a single puncture the cicatrices are usually small; when the opposite is the case the size of the scar may be commonly attributed to the extent to which the point of the lancet is pushed under the surface.

Districts in which the prevailing character of the vaccination was unsatisfactory.

In the 10 districts referred to in the following paragraph, the records of the examinations of children in the schools are such as to indicate an unsatisfactory state of vaccination, either in respect of the undue proportion of results recorded as "bad," the small proportion of children who appeared to have been protectively vaccinated, or the generally defective aspect of the scars.

Beaconsfield (Amersham).

Beaconsfield (number of children examined, 99; predominant number, 1; protection per-centages, good 5, bad 62). Most of the scars are misshapen patches, paler than the surrounding skin, irregularly pitted;

area not exceeding 2″. Applicants only are vaccinated, and vaccination is not maintained continuously. Dry lymph, stored on points in stoppered bottles, is inserted by puncture or abrasion.—Mortimer (number of children examined 47 ; predominant number 1 ; protection per-centages, good in 13, bad in 43). The scars are characteristic, but of irregular form ; area 7″. Most of the children are vaccinated from arm to arm by puncture, for which purpose cottage meetings are appointed ; when dry lymph (stored on points kept air-tight) is used, it is inserted by abrasion. The smallness of the scars results evidently from the mode of insertion.—Lechlade (number of children examined, 89 ; predominant number, 1 ; protection per-centages, good 18, bad 43). The scars vary in size and character, even on the same arm. It rarely happened that more than one scar exhibited a typical aspect. Area from 7″ to 12″. Vaccination is performed exclusively at the houses, and children are never assembled. Every quarter a supply is obtained from the National Vaccine Establishment, which is employed in the vaccination of 5 or 6 children. From these the best is selected as a vaccinifer, from whom all the children requiring it at the time are vaccinated from points, at their residences. With this view lymph is taken on the 9th day. The average number of vaccinations performed quarterly is 17, but the contractor would not hesitate to vaccinate 50 from one arm. The smallness of the scars might be sufficiently accounted for by the mode of insertion, by superficial puncture, but is probably in part attributable to the employment of the diluted lymph which is yielded by a vesicle past maturity.—Sherrington (number of children examined, 81; predominant number, 1 ; protection per-centages, good 18, bad 32). The scars are circular and characteristic ; area from 2″ to 9″, the smaller sizes most common. Cottage meetings are appointed occasionally in the summer, when arm to arm vaccination is practised. Lymph is inserted by puncture.—Bampton, No. 1 (number of children examined, 134 ; predominant number, 1; protection per-centages, good 31, bad 32). The scars are circular, and are usually mere smooth depressions ; area various, not exceeding 9″. The contractor vaccinates from house to house, using for the most part dry lymph stored on points, which he inserts by puncture.—Waddesdon (number of children examined, 99 ; predominant number, 2 ; protection per-centages, good 21, bad 29). The scars are uniformly circular and characteristic, but their area does not exceed 5″. The contractor rarely vaccinates from arm to arm; he inserts by superficial puncture, usingl ymph stored for not more than two days, on points.—Colnbrook (number of children examined, 110 ; predominant number, 1 ; protection per-centages, good 23, bad 45). Some of the scars are characteristic ; area 3″. Many are of irregular form, and scarcely recognizable. Children are vaccinated at the surgery, or at the houses of the poor, but they are very rarely assembled, so that the lymph employed is usually dry, although never kept more than a day. It is inserted by abrading the epidermis with the charged ivory point. Risborough (number of children examined, 71; prevalent number, 1 or 2 ; protection per-centages, good 19, bad 25). The scars are sometimes characteristic, but frequently consist only of whitish patches or smooth or wrinkled depressions ; area 3″. Vaccination is performed by superficial puncture, usually from arm to arm, for which purpose the children are assembled from time to time in cottages.—Lambourn (number of children examined, 61 ; prevalent number, 2 ; protection per-centages, good 23, bad 38). Scars variable in character and form, sometimes exhibiting radiating wrinkles, sometimes resembling the mark of a deep puncture or stab. The contractor vaccinates from house to house, but never assembles the children for the purpose ; he inserts dry

Mortimer (Bradfield).

Lechlade (Faringdon).

Vaccination of many children from one vaccinifer. Employment of 9th day lymph.

Sherrington (Newport Pagnell).

Bampton, No. 1 (Witney).

Waddesdon (Aylesbury).

Colnbrook (Eton).

Risborough (Wycombe).

Lambourn (Hungerford).

Wallingford (Wallingford).

lymph by a puncture of which the direction is nearly vertical—Wallingford (number of children examined, 228 ; predominant number, 2 ; protection per-centages, good 23, bad 33). Scars are of irregular form and character, often having the appearance of pale smooth depressions. Even in the same arm the marks vary in aspect ; area 7″–10″. Vaccination is performed both at the surgery on application and at the houses, but children are rarely assembled for the purpose. Recent lymph kept for short periods in bottle is used, and inserted by epidermal punctures. Occasionally vaccination is practised from arm to arm.

In ill vaccinated districts the aggregate area of cicatrix on one child often does not exceed a quarter of that exhibited by a child fairly vaccinated, or an eighth part of that of a child vaccinated by the contractor of Aylesbury.

In the districts above referred to as remarkable for the bad quality of the scars observed, the most prominent defect was that of size. The area of each scar varied from 2″ to 10″, and in most of the schools visited a large proportion of the children exhibited only a single mark, or at most two ; so that the whole cicatricial surface in each child varied from 2″ or 3″, as at Beaconsfield and Colnbrook, to 10″ or 12″, as at Waddesdon and Lechlade, whereas at Aylesbury the scarred surface amounted in many of the children to 83″, and 25″ may be regarded as the minimum area in children properly vaccinated. If, as there appears to be good reason for assuming, the protective power of vaccination is no less affected by the area of the vesicles than by their number, how great must be the differences between a population vaccinated according to the method employed at Aylesbury and that of any of the districts above referred to, in the very best of which the whole cicatrical area was unequal to that of a single full-sized scar.

In districts in which area only was in fault, the defect is usually exclusively owing to the mode of insertion,

In some of the districts (*e.g.*, Mortimer, Waddesdon, Sherrington, and Risborough) in which the smallness of size was the only defect observable, the scars being in other respects characteristic, this resulted, not from the defective quality or improper storage of lymph, but from the mode of insertion. In the four districts above named, there is every reason to believe either that vaccination is performed exclusively from arm to arm, or that if preserved lymph is used it is not kept for more than two or three days ; and it can also be stated with confidence that the operation is carefully performed. Lymph is inserted either by a single superficial puncture or by a minute abrasion for each intended vesicle.

and even when the scars are deficient in other respects, bad methods of operation often concur with the careless employment of preserved lymph in producing the result.

In the other six districts (Beaconsfield, Bampton, Colnbrook, Lechlade, Wallingford, and Lambourn) the scars were not only small, but exhibited various irregularities of form and character. In some instances these appeared to be the joint result of the careless storage of dry lymph, and of bad methods of insertion, as at Beaconsfield and Colnbrook, the two worst vaccinated districts visited. At Lechlade the practice of taking lymph from a single vaccinifer for the vaccination of a large number of children, in combination with a bad mode of insertion, could scarcely fail to produce unsatisfactory cicatrices, for it entailed upon the contractor the necessity of waiting until the ninth day in order to obtain a sufficient quantity of vaccine, and consequently of employing it in a state of greater dilution and diminished virulence. At Lambourn the peculiarity of the scars was clearly attributable to the unusual method of insertion practised, described by the contractor as consisting in making a "prod" into the integument.

RECOMMENDATIONS.

Recommendations,

The results of local inquiry in so far as they related to the quantity of vaccination performed and the working of the existing arrangements, were communicated in writing to the clerk for the information of the guardians of each union. In all of the unions inspected, excepting those of Oxford, Reading, Easthampstead, and Faringdon, it appeared either that the arrangements already in force required modification, or

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as to public arrangements.

that other measures conducive to the promotion of vaccination might be advantageously adopted. Suggestions to these effects were accordingly offered to the guardians.

The facts already stated show that in many instances, the greatest irregularity prevails as to the times and places at which vaccination is performed, and that in most of the rural districts the prescribed arrangements have been entirely departed from. Whenever these failures and irregularities could be traced to fundamental defects or inconsistencies in the public arrangements,—as, for example, when the vaccinator was required by his contract to attend at two distant stations on the same day and nearly at the same time, or when stations for vaccination had been fixed at many miles distance from the dwellings of the persons for whose benefit they were intended,—I deemed it to be my duty to recommend such modifications as were rendered necessary by the circumstances of each case. If, however, it appeared that the arrangements had become obsolete merely by reason of the impracticable character of their details and the unnecessary stipulations with which they were burdened, I thought it sufficient to suggest that the guardians should endeavour to give effect to such parts of the existing systems as were workable, without attempting to re-model the whole. In giving this advice I have invariably directed their attention to the general principles stated in the memorandum "On the subdivision of Vaccination, &c.," and have pointed out that the main object of all arrangements—the affording to the people the best facilities for arm to arm vaccination—could not be attained, especially in rural unions, if the contractors were required to attend too frequently or at too many stations in the same district, and that whenever stipulations of this nature had been already introduced into the contracts, the guardians would exercise a wise discretion in so far relaxing their stringency as to require that attendance should be given at each station at certain periods of the year only, as for example, during a few weeks in Spring and during a similar period in autumn.

When the small number of vaccinations annually performed in any district or union showed that the practice of vaccination was habitually neglected, even although proper facilities were afforded, I placed before the guardians the necessity of taking special means to induce the people to avail themselves of the opportunities offered. In such instances I have been in the habit of recommending that the guardians should inform themselves of all cases of neglect of vaccination by returns made from time to time *in each parish* of all unvaccinated children of fit age residing in it, and that the officers appointed by the guardians to take proceedings under the Vaccination Act Amendments Act, 1861, should be directed to give notice in writing to the parents of all such children to have them vaccinated, and to take proceedings in default.

Such further recommendations were offered as the special irregularities which presented themselves in the several unions appeared to require. Their nature may be judged of by the statements contained in the preceding pages.

4.—DR. BUCHANAN'S SUMMARY of the RESULTS of his INQUIRY in certain UNIONS in DORSETSHIRE and SOMERSETSHIRE.

4. Dorsetshire and part of Somersetshire, by Dr. Buchanan.

Amount of Vaccination.

Amount of vaccination.

THE returns annually made by fifteen unions to the Poor Law Board have furnished materials for the following tabular statement. Owing to the common omission of private medical practitioners to certify to the registrar cases vaccinated by them, there is rarely any better index

APPENDIX.

I. Local inquiries as to Vaccination.

4. Dorsetshire and part of Somersetshire, by Dr. Buchanan.

From public returns.

to the amount of vaccination in a locality than is supplied by the public returns. In the following, the vaccinations are compared with the births for the three years, 1859–61, and the annual vaccination rate (per cent. of the population) is also calculated for each union.

TABLE A.—Amount of Public Vaccination in 15 Unions.

No.	Name of Union.	No. of Vaccination Districts.	Vaccinations per cent. of Births 1859–61.		Annual Vaccination rate per 100 of Population.	
			Under 1 year.	Total Vaccination.	Under 1 year.	Total Vaccination.
1	Langport -	6	67·5	87·2	2·03	2·65
2	Poole -	4	62·0	90·8	1·97	2·88
3	Wareham*	7	58·5	117·0	1·94	3·86
4	Dorchester†	7	53·2	85·4	1·70	2·72
5	Wimborne	4	51·5	79·2	2·51	3·85
6	Blandford‡	5	48·8	102·0	1·42	2·92
7	Yeovil† -	7	45·7	66·0	1·58	2·26
8	Sherborne -	4	43·3	56·6	1·46	1·90
9	Cerne -	3	41·2	90·8	1·26	2·75
10	Chard -	7	38·9	62·1	1·30	2·10
11	Bridport -	6	36·3	61·3	1·27	2·14
12	Weymouth†	6	33·6	47·2	1·16	1·64
13	Shaftesbury	3	33·0	45·4	1·02	1·42
14	Beaminster	5	32·3	60·5	1·03	1·94
15	Sturminster	4	28·5	50·8	0·91	1·63

The fifteen unions are here arranged according as their infantile vaccinations, by the public vaccinators, approach to the total number of registered births; very considerable difference in this respect will be observed between the highest and the lowest on the list. The amount of public vaccination at all ages does not appear constantly or closely related to the amount of infantile vaccination. Every where some arrears of vaccination have had to be made up in after years of life. In several unions, where there has been little alarm about small-pox, the bad habit of postponing vaccination until children are a year or two old, was found largely to prevail.§ The comparison of the public vaccinations with the population, made in the last two columns, is less important, since it appears that the birth-rate itself (or at all events the birth-rate derived from registered births) is extremely inconstant in the several unions.

From inspection of schools.

A further test of the amount of vaccination in the unions, more trustworthy than any derivable from documentary sources, was afforded by the actual examination of nearly ten thousand children in the elementary schools. Out of 9,725 children, 8,443 were found to have been vaccinated, while 1,282 were either unvaccinated or the scars on

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* The high per-centage of vaccinations at all ages in this Union is partially accounted for by adult vaccination under fear of small-pox, and partially perhaps depends on errors in the returns.

† In these unions there is some notable amount of private vaccination.

‡ Vaccination had here been suspended in 1858 in consequence of epidemic scarlatina, so that in 1859 many arrears were made up.

§ The figures of the 2nd and 4th columns would also be raised by re-vaccinations, but as a matter of fact the operation of secondary vaccination has been so seldom performed in any union during the three years in question that no important influence can have been thus exercised on the general vaccination rate.

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I. Local inquiries as to Vaccination.

4. Dorsetshire and part of Somersetshire, by Dr. Buchanan.

their arms were doubtful.* On the school-test therefore 13·2 per cent.† of the population in the unions visited appeared to have escaped vaccination. For each union the number of children examined, and the per-centage of unvaccinated (herein including the doubtful) among them is shown the following :—

TABLE B.—Unvaccinated Children in the Schools of 15 Unions.

No.	Name of Union.	Per-centage of Unvaccinated.	Actual number of Children examined.	Scarred with Small-pox.	
				Per 100 vaccinated.	Per 100 unvaccinated.
1	Langport - -	5·3	429	0·00	0·00
2	Blandford -	8·5	681	0·00	5·15
3	Beaminster -	10·0	322	0·00	0·00
4	Yeovil - -	11·3	824	0·00	25·20
5	Sherborne -	12·4	565	0·40	28·40
6–9	Dorchester -	13·3	851	0·00	11·50
	Wareham -	13·3	1,008	0·11	2·24
	Bridport - -	13·6	895	0·00	27·75
	Weymouth -	13·9	1,098	0·21	19·60
10	Poole - -	14·7	633	0·00	4·30
11–14	Wimborne -	15·4	464	0·00	2·74
	Sturminster -	15·5	355	0·00	1·81
	Chard - -	15·7	782	0·00	33·20
	Cerne - -	16·0	306	0·00	2·04
15	Shaftesbury -	17·4	512	0·00	9·00
	The 15 Unions taken together	13·2	9,725	0·059	14·40

It will be noted that the correspondence between the position of the unions in the two foregoing tables is by no means close. The varying amount of private vaccination, the occurrence of more or less small-pox, and the different ages at which children are vaccinated in one or another district, are samples of the causes producing apparent discrepancy.

From the last columns of the above table may be learnt the localities that have most suffered from small-pox. It will be useful thus far to anticipate what has to be said as to the prevalence of this disease, and to point out at once that the unvaccinated children were scarred by small-pox 244 times as much as those who had been vaccinated.

Amount of vaccination. Influence of Guardians on.

The amount of the local vaccination is much affected by the arrangements that are in force, and by the supervision that is exercised in the several unions. In this sense the various boards of guardians are largely responsible for the sufficiency of vaccination.—All the unions were found to be divided into districts, which in all cases but one were the same for vaccination and for Poor Law medical relief. The exception is instructive. The Langport Union is not divided into so many districts for vaccination as for medical treatment, and the usual result of concentrating vaccination upon a few performers follows: this union is at

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[*] The doubtful vaccinations amounted to 105. In all such cases the probability was against there being any scar of successful vaccination. Sometimes a very faint or an extremely small scar was thus counted, or else the doubt arose from no scar being visible on an upper arm that was covered with eruption. Eight of the 105 children reckoned as doubtful were such as, being scarred by small-pox, exhibited about the deltoid marks that might have come either from vaccination or small-pox. Altogether nine of the doubtful cases were scarred by small-pox.

[†] It may be allowed here to mention that at the inspection in 1861 of Norfolk and part of Suffolk the proportion of unvaccinated in the school was found to reach 20 per cent.

APPENDIX.

I. Local inquiries as to Vaccination.

4. Dorsetshire and part of Somersetshire, by Dr. Buchanan.

Contract arrangements.

How superseded.

Qualifications of vaccinators.

the head of both the foregoing tables.—In 10 of the 15 unions there were due contracts for vaccination between the guardians and medical practitioners ; in some single districts, however, the contract not having been renewed on the appointment of the actual present vaccinator. But in five of the unions there were no contracts for vaccination. In one union, at least, it was expressly stated that contracts were dispensed with, through the impracticable nature of the arrangements that were supposed to be proper to these documents.—The arrangements made by the contracting parties were generally for weekly vaccination at the contractor's surgery, and for monthly attendances at stations ; a scheme which in rural districts is perhaps the most utterly fatal to the proper performance of the operation. Accordingly, in practice the use of any contract station (but the surgery) at contract times was universally discontinued, and out of 70 vaccinators in the 15 unions 12 only were found who ever at any time attended at the appointed stations. Eight other vaccinators, chiefly in the towns, having no other station named than their own surgeries, did also to some extent keep to the provisions of their contracts by doing some part of their vaccinations there. With hardly an important exception, all the vaccination done in the 15 unions was performed by the contractors according to private arrangements of their own. They usually set apart one or two periods of the year, and at such times got together or visited all children known to require vaccination. Fifty-two out of the 70 vaccinators trusted entirely to their own arrangements, and in only rare cases vaccinated even at their surgeries. Five of these 52 vaccinators contrived to get the mass of their vaccination directly from arm to arm, by appointing from time to time private meeting places for the children. Thirty-four others, doing some arm-to-arm vaccination in this way, still did the majority by visiting the children at their own houses ; and the remaining 13 never vaccinated any children except by themselves going from house to house. But in none of these instances had a board of guardians inquired into the arrangements that were thus superseding the attendances contracted for ; and being satisfied that many children did get vaccinated, they do not appear to have ever considered how incompatible these irregular private arrangements were with the universal performance of vaccination.—The payment made to the contractors was in every union but one the minimum prescribed by law, but in Langport it was 2*s.* 6*d.* per case, irrespective of distance. This is another circumstance that may have had an influence in placing Langport first among the well vaccinated unions.* In the Cerne Union only did any difficulty appear to have been raised about paying the contractor for cases of successful re-vaccination.—The qualifications of 69 out of the whole number (72) of public vaccinators were satisfactory, but in the other three cases gentlemen whose medical diplomas were of later date than 1859 were found not to possess the special certificate required by the rules of the Council. In no instance was a vaccinator permitted by his contract to employ any person as his deputy, but in practice only 50 out of the 72 did the whole of their vaccination in person. The deputies who acted for the remaining 22 practitioners were in seven instances their partners, in eight cases were assistants more or less "qualified," whilst seven vaccinators entrusted their duties to unqualified assistants.

Notifications.

The other functions of the guardians which affect the amount of vaccination in their union are the giving of notifications and the directing

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* Former experience, however, in the Eastern counties, has shown how little medical men allow themselves to be influenced in their anxiety to vaccinate by the amount of their fee. In the Langport Union, the higher payment is certainly only one of several causes that conduce to the satisfactory quantity of vaccination there.

of proceedings for the recovery of penalties. In all 15 unions some notifications by placard or handbill had been issued since the passing of the Act of 1853, but for the most part these notifications had not been adequately renewed. Indeed, in two unions only were the existing arrangements for vaccination properly advertised. Proceedings for the recovery of penalties had been taken with the cognizance of the guardians in four unions, and had not been taken at all in the remaining 11. The guardians have used their power under the Act of 1861 to appoint a person to enforce the vaccination laws in two instances only, in one union appointing their clerk and in the other their relieving officers.*

Proceedings for penalties.

Amount of vaccination. Influence of Registrars on. Notice to parents.

Registers.

Receipt of certificates.

The Registrars of births and deaths have next to be considered in their influence upon the amount of public vaccination. The notice of requirement of vaccination (Schedule C. of the Compulsory Vaccination Act) was regularly given to parents by 42 out of the 47 registrars who were conferred with. This notice was invariably in the form provided by the Registrar-General, and in the Poole and Blandford unions was accompanied by a printed memorandum of the contract arrangements for vaccination. Of the 47 registrars, seven omitted to announce any arrangements in their notice, five announced them irregularly, and of the remaining 35 fourteen only habitually announced the contract arrangements that had been settled by the guardians. A minute of the due delivery of this notice was regularly made by 35 registrars, but other 12 registrars kept no such minute.—The register of successful vaccination was duly kept in 33 of the 47 sub-districts. In the other sub-districts, however, five registrars made entries in their register only as they received certificates from medical men; three had let their books get into considerable arrears, and six had kept no register at all. The irregular registers were met with in sub-districts of seven unions, but principally in the unions of Yeovil and Sherborne. Duplicate certificates were received from the public vaccinators by almost all the registrars, but had not been lately sent to some of those registrars who kept no book. With few exceptions these certificates were believed to represent the whole number of children vaccinated by the contractors in their public capacity. In Wimborne and Blandford unions the rule had been adopted of making the payment to the vaccinator contingent on his duly sending these duplicate certificates to the registrar. Certificates were in scarcely any instance duly received by the registrar in respect of the vaccination done by private practitioners in his sub-district, 41 of the registrars getting no such private certificates, or only very rarely.

Other proceedings of Registrars.

The registrars have in most unions assisted to promote vaccination in other ways. Twenty-six of them have prepared lists of unvaccinated children for the guidance of the public vaccinator; and 24 registrars have by inquiries and admonitions in their district rendered further assistance to him. In the unions of Yeovil, Shaftesbury, Chard, and Sherborne, registrars have taken proceedings against persons who had neglected vaccination, and have in all cases obtained convictions. A written warning preceding a summons was served on the defaulting parent by certain of these registrars. In the Chard and Langport unions the absence of a provision for a compulsory registration of births had been strongly felt as a hindrance to the complete vaccination of a district.

Amount of vaccination.

Although in theory the law has entrusted to the guardians and the registrars the functions upon whose due performance the amount of

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* The returns to the Poor Law Board, made by the several boards of guardians, were found to be compiled by the clerk from the contractor's register in the case of ten unions; in four unions the data for these returns were obtained from the vaccinators themselves, and in one union were obtained from the contractors' bills. A good many instances of inaccuracy in these returns came to light upon a careful examination of the registers kept by the vaccinators.

APPENDIX.

I. Local inquiries as to Vaccination.

4. Dorsetshire and part of Somersetshire, by Dr. Buchanan.

Influence of contractors on.

public vaccination is meant to depend, and has left to the contractor the sole duties of operating, inspecting, and certifying, yet in practice the contractors have had a much greater influence than this on the quantity of vaccination done in their districts. Arrangements of their own having superseded the impracticable arrangements of their contracts, they have assumed much of the responsibility of giving notifications and of detecting the unvaccinated. In the unions visited the contractors have often endeavoured by personal visits, by sending messengers, or by distributing handbills, to get children together for vaccination, and failing of success in these ways they have gone about, lancet in hand, inquiring for unvaccinated children from house to house. The compulsory proceedings for neglect of vaccination too have been usually set on foot through the representations of the contractor. The apparent advantages with the large countervailing disadvantages of the system of leaving everything to the contractors, have been sufficiently discussed in a former report, and here it will suffice to say that the present inspection has confirmed the conclusions before arrived at. One of the most obvious disadvantages, however, cannot be too frequently insisted on, that this system encourages the postponement of vaccination until children have passed the age of infancy. Several even well vaccinated districts have been noted where the average age at the time of the operation has been upwards of two years; but, of course, when vaccination is put off till this age, it is very often omitted altogether or until small-pox has gained a footing in the district.*

Workhouse vaccination.

* Within the Workhouse the medical officer is responsible for the due vaccination of all inmates. The children in the workhouse schools were examined in each union, and everywhere some had been overlooked; the medical officers not having felt the necessity of ascertaining with their own eyes the existence of vaccine marks upon every person admitted.

In the following the unions are shown according to the degree to which this omission had gone:—

TABLE D.—Vaccination in Workhouses.

Union Workhouse.	Total children over 3 months examined.	Unvaccinated Children.			Per-centage of unprotected and overlooked.
		Total.	Having had Small-pox.	Operation knowingly deferred.	
Langport - - -	48	3	—	1	4
Dorchester - -	23	1	—	—	4
Wareham - -	49	4	—	1	6
Sturminster - -	32	2	—	—	6
Bridport - - -	57	6	2	—	7
Yeovil - - -	67	12	4	3	7
Cerne - - -	27	2	—	—	7
Sherborne - -	12	2	—	—	8
Shaftesbury - -	30	5	—	2	10
Blandford - - -	46	5	—	—	10
Poole - - -	43	8	—	3	11
Chard - - -	55	16	3	6	12
Wimborne - -	43	6	—	—	14
Weymouth - -	49	18	11	—	14
Beaminster - -	49	9	—	—	18

At Sherborne only a part of the children were examined at the workhouse; the rest being included with the scholars of the National school at which they attended.

Efficiency of Vaccination.

Under this head may be considered ;—1st, the characters of the vaccine cicatrices observed on the children in the schools ; 2nd, the occurrence of small-pox among persons who had been vaccinated ; and 3rd, the practice of the district vaccinators, especially their method of operating and their management of lymph : as far as possible this will be considered with reference to the results witnessed in the district schools.

Judged from schools.

1st. The school children, to the number of 8,443, who were found to have vaccine scars, were classified according to the number and according to the quality of the scars they bore. Both these elements, number and quality of scar, are proved by experience to be indicative of the protective value of a vaccination, and they may be combined as follows to express three grades of efficiency.* Two or more typical scars may be held to constitute good protection against small-pox ; one typical or two or more passable scars, moderate protection ; one passable scar, or any number of bad scars, bad protection. This classification is adopted in the following table, where the efficiency of vaccination is shown for each union. Taking the 15 unions together, 4,461 children, or 52·8 per cent. of all the vaccinated, were well protected against small-pox ; 2,424, or 28·7 per cent., were moderately protected ; and 1,558, or 18·5 per cent., were badly protected.

Different degrees of protection conferred.

TABLE C.—Efficiency of Vaccination in the Schools of 15 Unions.

Union.	In 100 Vaccinated Children, protection was		
	Good in	Middling in	Bad in
Weymouth - - - -	64	23	13
Bridport - - - -	58	25	17
Sturminster - - - -	57	27	16
Blandford - - - -	57	26	17
Beaminster - - - -	56	26	18
Poole - - - - -	55	27	18
Shaftesbury - - - -	53	28	19
Yeovil - - - -	52	30	18
Wareham - - - -	50	31	19
Chard - - - -	50	28	22
Wimborne - - - -	49	32	19
Dorchester - - - -	49	30	21
Cerne - - - -	46	36	18
Langport - - - -	46	34	20
Sherborne - - - -	40	35	25

The unions are arranged according to the greater or less efficiency of their vaccination, and it will be seen that there is no relation between their places on this table and on those (A. and B.) which indicate the relative amount or quantity of the vaccination in them. A very wide difference in the quality of vaccination will be observed between the unions at the top and the bottom of the list, but this difference is far more marked in the separate vaccination districts. In the same union extremely good and extremely bad vaccination may be found side by side, the quality depending so very much upon the care of the particular

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* Such a classification is recommended by its simplicity and practical usefulness. But to the exact point of division here adopted it may be objected that too low a standard of efficiency is assumed. It appears better, however, in a report to err a little on this side. One scar, if of unusual size, is counted as equivalent to two or more ordinary sized ones.

operator. Thus the Sherborne Union obtains the lowest place in this list through the great number of children vaccinated in Sherborne town by one insertion only, the typical character of the scar being often wanting. Thirty-eight per cent. only of the town-children can be reckoned as well protected. But in the adjacent north-west district of the same union, 68 per cent. were efficiently vaccinated, most of the children having four typical scars. In the detailed reports, of which the present is a summary, the efficiency of the vaccination in each contractor's district is reduced to a numerical expression.

Efficiency judged by resistance to small-pox.

2nd. Small-pox was observed to have scarred five persons among the 8,443 vaccinated. These were all children classed by their cicatrices among the badly vaccinated. In at least four cases out of the five the vaccine cicatrices were smooth, or puckered with a bit of hard tissue in their centre, showing that the vesicles had ulcerated instead of having run their normal course.* The number of scarred faces in vaccinated persons cannot, however, be usefully appealed to as evidence of the relative efficiency of vaccination in each union, owing to the very different intensity with which the small-pox influence has fallen on different parts of the counties.—In this place may be mentioned that nearly all the vaccinators were in the habit of performing revaccination in the presence of smallpox, or when they were requested to do so. But none of them had carried out any general revaccination of the community as a matter of principle.

Efficiency as indicated by the practice of the vaccinators.

3rd. Inquiry was made respecting the method of operating, of selecting, conveying, and storing lymph from the 72 public vaccinators of the 15 unions. Their registers were also examined, and a summary of the contents of each was made for the past three years.

Insertion of lymph.

The number of insertions of lymph habitually practised was found to be six in the case of one vaccinator, while ten others made four insertions.—The rest of the vaccinators habitually produced fewer vesicles than the lowest number enjoined in the instructions of the Council. To make three insertions was the practice of 36 vaccinators, while 21 made only two punctures, and two others did not even always make two. In this statement vaccination by a scratch or other method that produces several vesicles is reckoned as a multiple insertion.

Mode of operating.

—The most common way of operating was by puncture, 34 of the vaccinators using this plan. One operated by numerous minute pricks close together, one by a long scratch, and 22 by some method of scratching or scraping off the cuticle. Four vaccinators were inconstant in their mode of operating, and of the habits of the remaining ten no note was made. The instrument employed in the operation was in one case a needle and in ten cases a special instrument, while 54 of the practitioners used an ordinary lancet, a few preferring it to be blunt.

Taking and storing lymph.

Careful inquiry was made as to the day of taking lymph and the way of storing it. Fifty-four vaccinators took this lymph strictly on the eighth day, ten had a preference for lymph of the seventh day, while eight others very commonly used ninth day lymph. All however used more or less of

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* With reference to these glazed scars, the experience of this year has not added much to what was learnt about them in the inspection of vaccination in Norfolk. An interesting circumstance, however, deserves mention as showing how little protection is conferred by vesicles that proceed to ulceration, even against cow-pox itself. In the Marshwood district of the Beaminster Union, the contractor vaccinated his own child and several others with lymph procured from a Bridport practitioner; in most if not all the cases the arms got very sore and ulcerated. About six weeks afterwards the children were vaccinated a second time with other lymph, and in every case a perfectly normal vaccine vesicle appeared and ran its course as if there had been no former vaccination at all.

eighth day lymph. Only about one in five of the vaccinators had the habit of storing lymph for any length of time. Most of them kept their lymph for a period of less than a week, and on an emergency or to begin a batch of vaccinations, they applied to the National Vaccine Establishment, or else to their neighbours, for a supply. Of 70 vaccinators, 48 were found to preserve their lymph exclusively on points, nine upon glasses, and two only employed capillary tubes to the exclusion of other methods. Eleven vaccinators, however, had more than one way of storing and conveying lymph, and of these four were found to employ tubes. For the simple carrying about of lymph, three operators used the stopper of a bottle, and one only is noted as habitually gaining this object by the use of charged lancets.

Registers.

The vaccinators' registers were in no case found to indicate the source of lymph from whence each person was vaccinated. Nor when secondary vaccinations had been performed were they anywhere distinguished as such by the register. Just one-third of the vaccinators omitted to enter their unsuccessful cases, contenting themselves with repeating the operation until it did succeed, and then registering the case. As an example of the valuable information that may be lost by this omission, may be cited the instance of a vaccinator who had formerly operated by puncture but latterly by abrasion. His register showed that coincidently with the change of method, his failures had fallen from 20 per cent. to 6½ per cent., and recently had not exceeded 2 per cent. Irregularities in keeping the register, more serious than the above-mentioned omissions, were observed in the cases of seven contractors, while in ten vaccination districts (comprising the whole unions of Wimborne and Shaftesbury, with other separate districts) no register at all was kept by the vaccinators.—The proportion of the total vaccination that was performed on infants under three months, under one year, and at four other periods of life, was ascertained from the registers, and is recorded in the detailed reports on the several districts. In brief, it was found that out of 56 vaccinators, seven succeeded in getting their vaccination done at so early an age that nine-tenths of their cases were in infants under one year old. Three-quarters of those vaccinated were infants in the case of 21 other operators. The remaining 28 habitually did more than a quarter of their vaccination on children above a twelvemonth old, eight of them doing more than half their vaccination upon children who had passed this age.

Age at vaccination.

Connexion between vaccinator's practice and quality of resulting cicatrix.

The connexion between the manner of operating, as described by the vaccinator, and the quality of the scars in the school children of his district could be traced with accuracy in 41 only out of the 72 vaccination districts. In these the majority of children had been operated on by the public vaccinator himself, and not by a predecessor, by an assistant, or by a private operator.

First, as to the day of taking lymph, a majority of the contractors who refused to employ lymph later than the eighth day exhibited the bulk of the scars on the school children well pitted and depressed. On the other hand a majority of such vaccinators as did not refuse ninth day lymph showed in their schools a large proportion even of the best scars wanting in these perfect characters of a typical vaccine cicatrix. Though in itself amounting only to a probability, still the evidence on this point went to confirm the general opinion in favour of lymph taken not later than the day week after the operation.—Habitual vaccination of a district from house to house does not appear, from the experience of these 41 districts, to have had any ill effect upon the quality of the cicatrices. It has probably a more constant effect upon the number of the insertions, owing to the indisposition of parent and operator to submit to the tediousness and trouble incident to the usual methods of vaccinating by stored lymph.—The way of preserving lymph did not appear to have had any influence upon the quality of the cicatrices produced by its use ; some districts where point-vaccination was universal showing schools with a poor average of quality in the vaccine scars ; while in as many other districts the quality of the scars was perfectly good. Those districts whose contractors were in the habit of storing in capillary tubes were few in number, but there was certainly no particular excellence of vaccine scars observed in their schools.—A more important influence over the quality of the cicatrices appeared to be exerted by the manner in which the insertion of lymph was made. It might be expected that the scars resulting from vaccination by abrasion would be larger than those left after vaccination by puncture. But, while this is true, it is also found that the scars are much better furnished with their typical pits in the schools of those districts where abrasion prevails than is common in districts where it is the rule to puncture. Thus in 23 districts where it was the habit of the operator to puncture, the ruling type of scar was only medium in size and pitting in 15 of these districts ; it was medium in size but well pitted in three, and large in size and well pitted in five. Whereas in 13 districts where the plan of operating by abrasion or scratching prevailed, the general character of scars was noted as being above the average in size and pitting in 11, large in size and medium in pitting in one, and medium in size and pitting in another. When to this fact is joined the much greater success of the operation by abrasion, it appears certain that the efficiency of vaccination would be much promoted by the wider adoption of this method. For the insertion of dry lymph it seems in all ways infinitely preferable to the operation by puncture.

Small-pox, and its connexion with the Local Vaccination.

Small-pox. In vaccinated and unvaccinated school children.

In the schools of the 15 unions, 190 children were found scarred by small-pox. Five of these were among the 8,443 vaccinated, being 0·059 per cent., or 1 in 1,680 ; nine were among the 105 whose vaccination was doubtful,* being 8·55 per cent., or 1 in 12 ; the remaining 176 children scarred by smallpox were seen in the 1,177 unvaccinated, being 14·95 per cent., or more than 1 in 7. The vaccinated children were therefore protected against disfigurement by small-pox 252* times better than the unvaccinated children.

Localization of epidemic small-pox.

By a reference to Table B. it will be seen that the number of school children scarred by small-pox was much greater in some unions than in others. The Chard and Yeovil unions, in Somersetshire, and the adjacent union of Sherborne, in Dorsetshire, suffered seriously in 1858 from an epidemic that prevailed throughout Somersetshire for quite a year and a half. In Chard† Union a third, and in Yeovil and Sherborne more than a quarter of the unvaccinated children were found scarred by small-pox. Langport Union, situated in the very heart of the infected district, was comparatively exempt from small-pox in 1858, and doubtless earned its exemption by the completeness of its vaccination. Enough

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[*] See Table B. on page 109 and the footnote * to page 109. "Unvaccinated" children in Table B. comprise the doubtful cases, and then the number of scarred faces among them comes to be 14·40 per cent, and the ratio of protection against disfigurement by small-pox thus comes to be 244:1 instead of 252:1 as above given. The discrepancy is only worth pointing out in order to avoid the appearance of error.

[†] Among the elder children in the town of Crewkerne in the Chard Union the prodigious number of 35 out of 44 unvaccinated children were scarred by small-pox, while not a single vaccinated child was so scarred out of 121.

cases occurred in its villages to prove the presence of a strong epidemic influence, but there were very few deaths, and, during the inspection, not a single scarred face was seen among the school children within the limits of this union. Dorchester, Weymouth, and Bridport were the other unions that showed evidences of epidemic small-pox on the faces of the school children. As these unions comprise a county town and two seaports they are, of course, especially liable to be invaded by epidemic disease, and against small-pox they have only a moderately good amount (Table B.) of vaccination to protect them. The small-pox epidemic of 1858, affecting severely Somersetshire and parts of Devonshire, only prevailed to a serious degree in the parts of Dorsetshire that abut on those two counties. A report on this epidemic as it affected Bridport has already been made by Dr. Seaton. It is sad to record that in the Abbotsbury district of the Weymouth Union it came to the knowledge of the registrar that inoculation for small-pox was being practised in 1858. Nearly all the early cases of the disease appeared referable to this cause. At the eastern side of Dorsetshire small-pox was far less prevalent, and accordingly there were fewer school children observed to be scarred in the eastern unions; there were few even in the harbour towns of Poole and Wareham.

Inoculation.

The only place in which small-pox was found to exist at the time of inspection was Dorchester. Hither it appeared to have been imported from Southampton, and new cases were occurring with rather threatening rapidity. The schools were inspected as rapidly and thoroughly as possible, and placards of warning were distributed. An increase in the amount of vaccination took place, and the outbreak of small-pox was confined within very narrow limits.

Recommendations.

Recommendations have been addressed, where necessary, to registrars and public vaccinators, urging the strict fulfilment of their duties and an exact compliance with their instructions. To the boards of guardians or their clerks deficiencies in the amount of the local vaccination have been pointed out, and the importance of a systematic supervision of the vaccination arrangements has been insisted on. A letter from the Poor Law Board having requested that the medical inspectors of the Council should make no recommendations at variance with the principles on which the vaccination contracts have been hitherto based, it has not appeared possible, while obeying that letter, to recommend such changes in the contract arrangements as were advocated throughout a former inspection, with a view to promote arm-to-arm vaccination, and to maintain the local supply of lymph.

APPENDIX.

II. Statistics of the National Vaccine Establishment.

II.—STATISTICS of the NATIONAL VACCINE ESTABLISHMENT.

1. Details for the Year 1858.

Members of the National Vaccine Establishment supplying Lymph for the Public Service.	Vaccinating Stations.	Number of Vaccinations performed at the Stations respectively.	Number of Charges of Lymph supplied from the Stations respectively.	REMARKS.
Vaccinators salaried from the Parliamentary Grant.	1. Surrey Chapel -	2,670	45,412	
	2. Battle Bridge -	327	12,002	
	3. Bermondsey -	373	7,412	
	4. Bloomsbury -	355	13,729	
	5. Dean Street, Soho	205	13,609	
	6. Islington (Upper)	90	12,125	
	7. Islington (Lower)	102	7,487	Was discontinued in December.
	8. Kennington -	42	717	Was discontinued in June.
	9. King Street, Portman Square.	280	10,147	
	10. Paddington -	72	4,036	
	11. Pimlico - -	162	5,668	
	12. Queen's Square, Westminster.	82	7,932	
	13. Russell Place -	832	27,977	
	14. Shoreditch -	153	5,483	
	15. Spital Square -	204	10,928	
	16. Stepney - -	209	41,311	
	17. Wellclose Square	287	8,175	
Total -	17 Stations, reduced during the year to 15 - - -	6,445	234,150	
Parochial and other Vaccinators, not salaried from the Parliamentary Grant, but furnishing Lymph at a fixed rate of payment.	None - -	None -	None -	*See* following Tables.
General Total	17 Stations, reduced during the year to 15 - -	6,445	234,150	

II.—Statistics of the National Vaccine Establishment—*continued.*

Appendix.

II. Statistics of the National Vaccine Establishment.

2. Details for the Year 1859.

N.B.—The Stations named in *italics* are Educational Vaccinating-Stations, authorized by the Lords of the Privy Council for the purposes of their Lordships' Order of December 1, 1859.

Members of the National Vaccine Establishment supplying Lymph for the Public Service.	Vaccinating Stations.	Number of Vaccinations performed at the Stations respectively.	Number of Charges of Lymph supplied from the Stations respectively.	Remarks.
Vaccinators salaried from the Parliamentary Grant.	1. *Surrey Chapel* -	3,389	72,009	
	2. Battle Bridge -	353	23,902	
	3. Bermondsey -	490	8,693	
	4. Bloomsbury -	372	17,194	
	5. Dean Street, Soho	262	13,186	
	6. Islington (Upper)	24	2,283	Was discontinued in March.
	7. King Street, Portman Square -	484	10,268	
	8. Paddington -	16	898	Ditto.
	9. Pimlico - -	49	1,684	Ditto.
	10. Queen's Square, Westminster -	25	2,186	Ditto.
	11. Russell Place -	697	12,634	
	12. Shoreditch -	11	453	Ditto.
	13. Spital Square -	246	14,610	
	14. Stepney - -	135	30,060	Was discontinued in December.
	15. *Tottenham Court Chapel* - -	94	2,752	Began in Dec.
	16. *Wellclose Square*	440	8,277	
Total -	15 Stations, reduced during the year to 10 - -	7,087	221,089	
Parochial and other Vaccinators, not salaried from the Parliamentary Grant, but furnishing Lymph at a fixed rate of payment.	1. *Manchester* -	1,139	10,032	Began in March.
	2. *Birmingham* -	267	663	Began in October.
	3. *Bristol* - -	62	390	Began in August.
	4. *Hull* - - -	90	1,462	Ditto.
	5. *Newcastle-on-Tyne* - -	39	430	Began in Nov.
	6. Oxford - -	55	519	Began in July.
	7. *Sheffield* - -	291	3,216	Began in June.
Total -	From 0 to 7 Stations	1,943	16,712	
General Total	15 Stations, increased during the year to 17 -	9,030	237,801	

APPENDIX.

II. Statistics of the National Vaccine Establishment.

II.—Statistics of the National Vaccine Establishment—*continued.*

3. Details for the Year 1860.

N.B.—The Stations named in *italics* are Educational Vaccinating-Stations, authorized by the Lords of the Privy Council for the purposes of their Lordships' Order of December 1, 1859.

Members of the National Vaccine Establishment supplying Lymph for the Public Service.	Vaccinating Stations.	Number of Vaccinations performed at the Stations respectively.	Number of Charges of Lymph supplied by the Stations respectively.	REMARKS.
Vaccinators salaried from the Parliamentary Grant.	1. *Surrey Chapel* -	1,630	16,123	
	2. Battle Bridge -	607	12,361	
	3. Bermondsey -	743	9,513	
	4. Bloomsbury -	281	5,294	Was discontinued in June.
	5. Dean Street, Soho	287	5,986	
	6. King Street, Portman Square	713	15,674	
	7. Russell Place -	567	4,809	
	8. Spital Square -	293	16,146	
	9. *Tottenham Court Chapel* -	1,149	37,530	
	10. *Wellclose Square*	363	13,154	
Total -	10 Stations, reduced during the year to 9	6,633	136,590	
Parochial and other Vaccinators, not salaried from the Parliamentary Grant, but furnishing Lymph at a fixed rate of payment.	1. *Manchester* -	1,478	9,947	
	2. *Birmingham* -	1,441	9,639	
	3. *Bristol* - -	242	2,410	
	4. *Hull* - - -	229	4,904	
	5. *Liverpool* - -	943	26,765	Began in January.
	6. *London* (West) -	1,090	None.	Began in January.
	7. *Newcastle-on-Tyne* - -	418	16,916	
	8. Oxford - -	68	540	
	9. *Sheffield* - -	514	5,971	
	10. Westminster -	793	14,665	Began in February.
Total -	7 Stations, increased during the year to 10 - - -	7,216	91,757	
General Total -	17 Stations, increased during the year to 19 - -	13,849	28,347	

II.—Statistics of the National Vaccine Establishment—*continued.*

APPENDIX.

II. Statistics of the National Vaccine Establishment.

4. Details for the Year 1861.

N.B.—The Stations named in *italics* are Educational Vaccinating-Stations authorized by the Lords of the Privy Council for the purposes of their Lordships' Order of December 1, 1859.

Members of the National Vaccine Establishment supplying Lymph for the Public Service.	Vaccinating Stations.	Number of Vaccinations performed at the Stations respectively.	Number of Charges of Lymph supplied from the Stations respectively.	REMARKS.
Vaccinators salaried from the Parliamentary Grant.	1. Russell Place -	517	4,928	
	2. *Surrey Chapel* -	1,192	21,281	
	3. Battle Bridge -	408	4,917	
	4. Bermondsey -	452	8,273	
	5. Dean Street, Soho	282	4,772	
	6. King Street, Portman Square.	349	7,213	
	7. *Spital Square* -	428	7,411	
	8. *Tottenham Court Chapel.*	1,260	35,687	
	9. *Wellclose Square* -	412	16,890	
Total - -	9 Stations - -	5,300	123,362	
Parochial and other Vaccinators not salaried from the Parliamentary Grant, but furnishing Lymph at a fixed rate of payment.	1. *Manchester* - -	1,298	14,948	
	2. *Birmingham* -	1,284	11,259	
	3. *Bristol* - -	270	1,920	
	4. *Hull* - - -	275	6,631	
	5. *Liverpool* - -	961	18,816	
	6. *Pimlico* - -	755	None.	
	7. *Newcastle-on-Tyne*	411	25,264	
	8. Oxford - -	43	362	
	9. *Sheffield* - -	690	5,664	
	10. Westminster -	812	16,774	
Total - -	10 Stations - -	6,799	101,638	
General Total -	19 Stations - -	12,099	225,000	

APPENDIX.

II. Statistics of the National Vaccine Establishment.

II.—Statistics of the National Vaccine Establishment—*continued.*

5. Details for the Year 1862.

N.B.—The Stations named in *italics* are Educational Vaccinating-Stations authorized by the Lords of the Privy Council, for the purposes of their Lordships' Order of December 1, 1859.

Members of the National Vaccine Establishment supplying Lymph for the Public Service.	Vaccinating Stations.	Number of Vaccinations performed at the Stations respectively.	Number of Charges of Lymph supplied from the Stations respectively.	REMARKS.
Vaccinators salaried from the Parliamentary Grant.	1. Russell Place -	518	5,467	
	2. *Surrey Chapel* -	1,146	16,358	
	3. Battle Bridge -	429	5,016	
	4. Bermondsey -	520	7,203	
	5. Dean Street, Soho	345	2,799	
	6. King Street, Portman Square.	282	7,303	
	7. *Spital Square* -	350	17,593	
	8. *Tottenham Court Chapel.*	1,329	32,057	
	9. *Wellclose Square* -	365	15,614	
Total -	9 Stations - -	5,284	109,410	
Parochial and other Vaccinators not salaried from the Parliamentary Grant, but furnishing Lymph at a fixed rate of payment.	1. *Manchester* -	1,333	9,120	
	2. *Birmingham* -	1,292	9,959	
	3. *Bristol* - -	241	2,130	
	4. *Hull* - - -	190	3,680	
	5. *Liverpool* - -	967	19,848	
	6. *Pimlico* - -	812	None.	
	7. *Newcastle-on-Tyne*	406	24,724	
	8. Oxford - -	97	1,360	
	9. *Sheffield* - -	582	9,953	
	10. Westminster -	849	17,294	
	11. *Marylebone* -	1,096	3,997	Began in Feb.
Total -	10 Stations, increased during the year to 11 - -	7,865	102,065	
General Total	19 Stations, increased during the year to 20 - -	13,149	211,475	

APPENDIX.

II. Statistics of the National Vaccine Establishment.

II.—Statistics of the National Vaccine Establishment—*continued.*

6. Summary for Successive Years, from 1809 to 1862 inclusive.

Year.	Number of Vaccinating-Stations maintained by Salaries from the Parliamentary Grant.	Number of Vaccinations performed at these Stations.	Number of Charges of Lymph supplied to the Board from all Sources for the Public Service.
1809	8	733	2,580
1810	8	1,493	16,749
1811	9	3,108	23,362
1812	9	3,148	23,794
1813	9	4,521	23,219
1814	9	4,274	25,394
1815	10	4,686	32,190
1816	11	6,581	32,821
1817	11	7,771	44,376
1818	11	9,193	50,043
1819	12	6,289	50,116
1820	12	8,957	51,005
1821	12	6,933	48,105
1822	13	8,229	85,110
1823	13	8,230	—
1824	14	—	—
1825	14	11,354	77,800
1826	14	8,528	98,346
1827	15	8,713	108,635
1828	16	10,263	97,454
1829	15	12,079	100,259
1830	14	11,175	90,681
1831	13	11,326	88,477
1832	13	—	—
1833	13	—	—
1834	13	11,571	83,191
1835	12	—	—
1836	11	—	—
1837	12	—	—
1838	12	18,659	203,818
1839	12	13,144	665,395
1840	12	15,588	160,066
1841	12	15,361	152,668
1842	12	11,105	141,839
1843	12	9,797	158,494
1844	12	13,374	175,362
1845	12	10,167	158,531

APPENDIX.

II. Statistics of the National Vaccine Establishment.

II.—Statistics of the National Vaccine Establishment—*continued.*

6. Summary for successive Years, from 1809 to 1862 inclusive—*cont.*

Year.	Number of Vaccinating-Stations maintained by Salaries from the Parliamentary Grant.	Number of Vaccinations performed at these Stations.	Number of Charges of Lymph supplied from all Sources for the Public Service.
1846	13	9,774	155,774
1847	12	10,403	168,489
1848	17	11,790	174,991
1849	17	9,089	172,944
1850	17	10,025	179,370
1851	17	11,984	218,632
1852	17	11,219	215,630
1853	17	11,424	319,808
1854	17	9,198	229,532
1855	17	8,657	220,639
1856	17	7,039	210,942
1857	17	6,327	213,207
1858	17, reduced to 15	6,445	234,150
1859	15, reduced to 10	6,978	237,801*
1860	10, reduced to 9	6,633	228,347*
1861	9	5,300	225,000*
1862	9	5,284	211,475*

* Of these 902,623 charges of lymph received during the four years 1859–62, 312,172 charges were contributed by 11 parochial and other stations, which, though subsidiary for this purpose to the parent establishment, do not depend for their maintenance on the parliamentary grant. The principal of these contributory stations were as follows:—

Stations.	Charges of Lymph supplied in each year.			
	1859.	1860.	1861.	1862.
Manchester - - - -	10,032	9,947	14,948	9,120
Birmingham - - - -	663	9,639	11,259	9,959
Liverpool - - - -	—	26,765	18,816	19,848
Sheffield - - - -	3,216	5,971	5,664	9,953
Westminster - - - -	—	14,665	16,774	17,294
Newcastle-on-Tyne - - -	430	16,916	25,264	24,724
Hull - - - - -	1,462	4,904	6,631	,680

See Tables 2, 3, 4, 5.

7. STAFF of the ESTABLISHMENT at END of 1862.

N.B.—The Stations named in *italics* are Educational Vaccinating Stations, authorized by the Lords of the Privy Council, for the purposes of their Lordships' Order of December 1, 1859.

	Members of the National Vaccine Establishment supplying Lymph for the Public Service.	Vaccinating Stations.	Days and Hours of Attendance.
Vaccinators salaried from the Parliamentary Grant.	Mr. John Newton Tomkins.	Russell Place.	Mon., Tues., Wed., Thur., Fri., Sat.; 10—11.
	Mr. James Furness Marson.	*Surrey Chapel.*	Tuesday, Thursday; 1—2.
	Mr. George Lewis Cooper.	Battle Bridge.	Tuesday, Thursday; 12—1.
	Mr. Henry Sterry.	Bermondsey.	Tuesday, Friday; 2—3.
	Mr. Robert Wade.	Dean Street, Soho.	Monday, Wednesday; 12—1.
	Mr. Arthur Bernard Macann.	King Street, Portman Square.	Monday, Wednesday; 10—11.
	Mr. Wm. Jones Lewis.	Spital Square.	Monday, Thursday; 10—11.
	Mr. George Simpson	*Tottenham Court Chapel.*	Monday, Wednesday; 1—2.
	Mr. Wm. Jones Lewis.	*Wellclose Square.*	Tuesday, Saturday; 9—11.
Parochial and other Vaccinators not salaried from the Parliamentary Grant, but furnishing Lymph at a fixed rate of payment.	Mr. Evan Thomas.	*Manchester.*	Monday; 2—4.
	Mr. John Garner.	*Birmingham.*	Monday; 10—12.
	Mr. William Yeoman Sheppard.	*Bristol.*	Tuesday; 10—12.
	Mr. John Hare Gibson.	*Hull.*	Wednesday; 9—11.
	Mr. Arthur Browne Steele. Mr. John Henry Wilson. Mr. John Fenton.	*Liverpool.*	Monday, Friday; 9—10.
	Mr. Wm. Prue Jorden.	*Pimlico.*	Monday; 9—12.
	Dr. T. Fothergill McNay.	*Newcastle-on-Tyne.*	Thursday; 1—3.
	Mr. Edward Law Hussey.	Oxford.	Wednesday; 2—3.
	Mr. Henry Geo. Allanson.	*Sheffield.*	Tuesday; 3—4.
	Mr. William E. Grindley Pearse.	Westminster.	Monday, Thursday; 9—11.
	Mr. James George Gerrans.	*Marylebone.*	Monday, Thursday; 10—11.

III.—Industrial Diseases.

III. Industrial diseases.

1. Arsenic industry. By Dr. Guy.

1. Dr. Guy's Report on alleged Fatal Cases of Poisoning by Emerald Green; and on the Poisonous Effects of that substance as used in the Arts.

Origin of the inquiry.

Limits of the inquiry.

This inquiry had its origin in a letter addressed by order of Secretary Sir George Grey to the clerk of the Privy Council, December 24, 1861, enclosing an extract from a report made by Dr. Hillier. medical officer of health for the parish of St. Pancras, Middlesex, relative to the death by slow arsenical poisoning, through the use of Scheele's green, of a young woman who had been employed at an artificial flower makers, in Judd Street, Euston Road. This letter, with the accompanying extract, having been laid before the Lords of the Council, I received instructions on January 13, 1862, to proceed to an investigation of the facts of the case in question, which investigation was to be extended to the larger subject of the use of the poison in the arts, and its effect on health and life when so employed.

Dr. Hillier's report.

Two fatal cases in the same establishment.

The process known as "fluffing."

How the poison enters the system.

Symptoms.

Local effects.

Several persons affected by the poison.

Crowded state of the work-rooms.

Dr. Hillier's report stated, that during the month of November 1861, a young woman employed in Judd Street, in making artificial leaves, died from the effects of slow poisoning by arsenic; that she had been working in a manufactory with 60 or 70 women and children, using Scheele's green (the arsenite of copper), a substance largely used as a colouring matter, and known as a virulent poison; and that another young woman was said to have died from the same cause at the same establishment not many months previously. Though the report does not enter into minute details of the process of manufacture, it points out as the process which is most injurious that known as "fluffing," which consists in dipping the leaf into warm wax, and then powdering the green colouring matter on to the leaf from a kind of dredging-box. During this process a quantity of the fine particles of the poison must necessarily be inhaled, and thus enter the lungs and the blood, while other portions get under the nails, and on to the hands and dress, and unless great cleanliness be observed (which is not often the case) a quantity of it is taken with the food. The poison, thus admitted into the system, causes a number of most unpleasant symptoms, among which the report particularly specifies chronic inflammation of the stomach and bowels, irritation of the eyes, and great nervous debility and prostration, with local irritation of the skin of the hands, neck, and scalp when the powder is brought into contact with, and allowed to remain on those parts. Several of the workpeople questioned by Dr. Hillier stated that they were constantly ill after working with this powder, and he ascertained from Mr. Paul, a surgeon living in Burton Crescent, that he was repeatedly seeing patients from this factory suffering with symptoms of slow arsenical poisoning from the use of this pigment. The report also calls attention to the rooms in which these persons were then working. It represents them as somewhat crowded (about 24 people working in a space of about 3,600 cubic feet), and adds that the gas burnt at night rendered the air more impure, and diffused the poisonous emanations more widely.

No law applicable to the prevention of the use of emerald green.

Dr. Hillier, after stating that he was not aware of any law which would bear on the prevention of these injurious processes, gave it as his opinion that something ought to be done to put a stop to them, and suggested that the attention of the Secretary of State for the Home

III. Industrial diseases.

1. Arsenic industry. By Dr. Guy.

Department should be called to the subject. In the meantime he expressed a wish that ladies should be made acquainted with the fact that what are called *emerald greens* in artificial leaves and flowers are made of a material most poisonous, occasioning much disease to those employed in their manufacture, and attended with risk of great injury to themselves and those who are about them.

No substitute known at present.

Used for wall-papers and for confectionery.

Dr. Hillier then points out the well known fact, that though there are several other colouring matters not poisonous which may be used to produce green, there is no other known substance which gives a green of such peculiar brilliancy; and he concludes his report by stating that this same material is frequently employed in the paper for walls, and that it is sometimes employed in confectionery.

"The Dance of Death."

Letter from the Secretaries of the Ladies' Sanitary Association.

The attention of the public, which had been called to the subject of poisoning by emerald green through the inquest on Matilda Scheurer, held November 25, 1861, was still more forcibly arrested by a letter which appeared in the *Times* newspaper on the 1st February 1862, headed "*The Dance of Death*," and signed by the Hon. Mrs. William Cowper and Mrs. John Sutherland, secretaries to the Ladies' Sanitary Association; to which letter the writers appended a valuable communication addressed to the Right Hon. William Cowper, from the Royal College of Chemistry, by Professor A. W. Hofmann. The letter of the lady secretaries set forth that hundreds of young women and children, employed as artificial florists, were suffering in the most terrible manner from handling and inhaling the emerald green; that they worked in a stifling atmosphere; and that though they wrapped their faces tightly round with towels, all the precautions used were baffled by the subtle character of the light powder, which penetrated the system, and produced inflammation and ulceration of the mucous surfaces of the body. The letter further states that the inquest on Matilda Scheurer led the writers to a further investigation of the subject, and that they had found that in other instances death had been attributed to the same cause, while others had escaped her fate only by discontinuing their employment for a time. It is added that the workers generally dread the occupation, but dread still more the alternative of being without work.

Fatal cases.

Letter of Prof. Hofmann.

Large quantity of white arsenic contained in the green leaves and in head dresses.

Marks and tests of the presence of the poison.

Professor Hofmann's letter to Mr. Cowper contains some valuable information. He submitted to analysis the leaves from a lady's head-dress sent to him for the purpose, and found that a dozen of such leaves yielded, on an average, 10 grains of white arsenic; and as he ascertained that a ball wreath usually contains about 50 of these leaves, it followed that a lady might wear in her hair a quantity of emerald green containing 40 grains of white arsenic. Subsequent inquiries convinced him that these quantities were understated. The presence of emerald green was easily recognized by the brilliant colour, as yet unrivalled by any other green, and the presence of arsenic itself by the characteristic garlic odour given out on burning the leaves.

The poison largely used in the manufacture of green tarlatanes made into ball dresses.

The letter further states that the employment of this poisonous substance is by no means limited to the green wreaths which he had submitted to analysis; but that the green tarlatanes lately so much in vogue for ball dresses owed their colour to emerald green, loosely laid on with starch, and therefore very readily detached by the slightest friction. According to an analysis made by Professor Erdmann, of Leipsic, these green tarlatanes contain as much as half their weight of the poison, so that a ball dress made from 20 yards of this material might contain as much as 100 grains of white arsenic; and a Berlin physician had satisfied himself that from a dress of this kind no less than 60 grains powdered off in the course of a single evening. The

The arsenic-crowned queen of the ball.

writer very justly remarks that "the arsenic-crowned queen of the "ball, whirling along in an arsenic cloud, presents under no circum-"stances a very attractive object of contemplation;" but that the spectacle becomes truly melancholy when we think of the poor poisoned *artiste* weaving the gay wreath in the endeavour to prolong a sickly and miserable existence already undermined by this destructive occupation. These poisonous wreaths, it is added, have not even the merit of being in colour a truthful imitation of nature.

Use of the poison in Germany.

Professor Hofmann's letter contains some interesting and useful information respecting the use of emerald green in Germany. He tells us that the employment of arsenic-green in the manufacture of paper-hangings, in staining paper, in painting children's toys, &c., has attracted the attention of the sanitary authorities on the continent for many years past; and that in several of the German states, more particularly in Bavaria, the very country of arsenic colours (which are manufactured on a very large scale in Schweinfurt, a town in Franconia), the application of these colours to papering or painting rooms has been repeatedly proceeded against. An edict of the Bavarian Government, dated the 21st July 1845, expressly prohibited the manufacture and sale of arsenic-green paper-hangings; but this edict was repealed by an Act of the 23rd January 1848, "for industrial considerations," and the use of Schweinfurt green again permitted for house papering and painting, provided the colour was permanently fixed by appropriate means. This repeal of the law did not give satisfaction, for undoubted cases of poisoning by arsenic papers, even when glazed, were brought before the Academy of Munich on the 9th June 1860, and the Academy was called upon to represent to the Government the necessity of strictly enforcing the former regulations, and of removing all Schweinfurt green wall-colouring from public buildings, schools, hospitals, &c.

Largely manufactured in Schweinfurt, a town in Franconia.

Prohibition of the manufacture and sale of the arsenical paper-hangings in Bavaria, and repeal of the prohibition. The repeal objected to.

Arsenical paper-hangings and their effect upon health.

On the subject of arsenical paper-hangings and their effect upon health, the letter of Professor Hofmann contains some observations worth recording. He says that the effect has been doubted both by the chemist and the physician; but that the chronic poisoning by arsenic of persons living in rooms covered with arsenical papers has been proved experimentally, inasmuch as the presence of arsenic may be demonstrated in their secretions, especially if the elimination of the poison be accelerated by the administration of iodide of potassium. The poisonous effects thus produced are shown to be due to the dust of the pigment separated from the wall and dispersed over the rooms, and not to the development of arseniuretted hydrogen, or some other volatile arsenic compound, generated by the damp of the wall or by the organic constituents of the paper and the paste. Accurate experiments, repeated and varied, have disproved the theory of such gaseous emanations.

The limits and divisions of this inquiry defined.

These, then, are the documents upon which I am called upon to report. They both attribute to emerald green, as used in the arts, well marked and highly injurious consequences; they both confidently assume, as an occasional result, death itself. They seem to indicate the necessity for an inquiry which shall first set forth the more usual effects of the poison as introduced into the system of those who work with it, or are in any way exposed to it; and then proceed to ascertain, by the light of the information so obtained, whether it ever proves fatal, and if so, under what circumstances. The practical suggestions which may arise out of this inquiry will form a third and last division of the subject. Some valuable items of information as to the manufacture and sale of the poison, and the number, variety, and extent of its uses in the arts, may be expected to be brought together in the course of such an investigation.

1. *On the effects of emerald green, as used in the arts, on persons in whom it does not prove fatal.*

Emerald green synonyms.

Emerald green, or *Emerald*, is the name commonly given in England to the poisonous green powder known also as Scheele's green, after its discoverer; as Schweinfurt green, after the town in which (as stated in Professor Hofmann's letter) it is so largely manufactured; as Brunswick and Vienna green, for the same reason; and also as mineral green. In France it appears that it is sometimes known as *vert Anglais*, though this term is properly applied to the acetate of copper. It is imported in large quantities from abroad, and manufactured in still larger quantities in England. The quantity annually made in England has been roughly estimated to amount to from 500 to 700 tons. Dr. Horace Cory and Co., to whom I am indebted for much valuable information, state the quantity manufactured by them at about 70 tons per annum. It is found in the shops in four different varieties, which have the same chemical composition, and differ only in depth of tint according to the size of the minute crystals of which they consist. They are known as *satin green, soft, deep,* and *deepest;* but the persons who apply for them call them by different names, *emerald green*, or *emerald*, being the generic term.

Varieties.

Process of manufacture.

The process of manufacture, as shown to me and explained by Dr. Horace Cory, is conducted in the open air, in large wooden vats. Arsenious acid is first boiled in water, with crystals of carbonate of soda, till it is completely dissolved. This hot solution of arsenite of soda is then poured into a strong solution of sulphate of copper, and lastly, strong pyroligneous acid is added. The several mixtures are repeatedly stirred, and then allowed to settle. The aceto-arsenite of copper which results from this process is repeatedly washed, and at last poured on to a fine sieve, on which the pigment collects. It is imperfectly dried by exposure under a shed, packed in barrels, and so sold.

Ultimate chemical composition.

The ultimate chemical composition of the emerald green, as determined by Dr. Cory, is—arsenious acid, 6 parts; oxide of copper, 2 parts; acetic acid, 1 part. Two-thirds of the pigment, therefore, consists of arsenious acid.

Symptoms in men who make the poison.

In those who pack it.

As the emerald green at Dr. Cory's works is not only made in large quantities, but also scattered about the premises in removing it from the vats, in drying, packing, and carting, the workmen are constantly exposed to it, either in a moist or in a dry state. I therefore commenced my inquiry into the effects of the poison by questions addressed to these men. Of three men who had been employed chiefly in making the emerald green for the respective periods of 2, 6, and 7 years, one had boils and pimples, both before and since he assisted in the manufacture, but no other ailments; the second had a carbuncle, once on the neck, and once on the arm, which he attributed to the employment, but no other symptoms; the third, who had made the pigment off and on for two years, said that it gave rise to a little itching at the nostrils and round the bends of the arms. Three other men employed on the works, and engaged chiefly in packing the poison, said that they were affected nearly in the same way. In one it caused sneezing and itching about the nose; in another sneezing only; the third, who had been on the works 25 years, said that it always *serves him out* in sneezing. A lad who packs the pigment and also serves in the shop told me that the dust, as it floats about, causes slight headache, smarting

APPENDIX.

III. Industrial diseases.

1. Arsenic industry. By Dr. Guy.

of the nostrils, and a slight rash about the nostrils and face, but not elsewhere. He added that he had got used to it, and that it does not affect him much now.

The symptoms more severe in those who make the pigment under cover.

The manufacture of emerald green when carried on in the open air does not therefore appear to produce symptoms of great severity. But I was informed by Dr. Cory, that more severe effects are produced when the work is done under cover, and this statement was fully confirmed by Mr. S. Pavy, foreman to Mr. Kempton, of the Caledonian Road, Islington. He informed me that he was formerly employed in making the emerald green at a manufactory in Whitechaped, now abandoned, that the process of manufacture was the same as at Dr. Cory's establishment, but that it was mostly carried on under cover. He had only worked at it once, but, after the lapse of a month or six weeks, he began to suffer from blotches under the nostrils, and on the scrotum, where he had first a red rash, and then a brown scab. He went to the hospital for skin diseases, where he was recommended to give up his employment. He did so, and soon recovered. Mr. Fitzgerald, of Millbank, confirmed this description. He formerly manufactured the emerald green, working himself, and employing four or five men. They used to suffer in a marked degree from rashes about the nostrils, armpits, and scrotum, and from much itching in the last-named part. The symptoms, however, soon passed away on taking cooling medicines and rest. The men who drank suffered most. A workman now in the employ of Mr. Fitzgerald mixes the emerald green with oil into a paint for ship-builders and others (great precaution being used to keep the dust from filling the air), and after working for two weeks or so at a time, he suffers only from a slight rash about the nostrils.

From the details which I have just given of the process of manufacture of the emerald green, it may be inferred that it is not attended by any serious danger to the workmen employed in it; that when the work is done in the open air, the symptoms are very slight; that more severe symptoms are developed when it is carried on under cover; and that the process of packing the poison for sale, which exposes the workmen to the handling and inhaling of the powder, is productive of the most marked effects. The symptoms brought about by this kind of exposure to the poison are:—Sneezing, itching at the nostrils, a slight rash about the nostrils and face, itching at the bends of the arms, in the armpits, and on the scrotum, with rashes on those parts, boils (?), and slight headache. All these symptoms, it should be understood, are not combined in the same person, nor was any mention made by any of the persons questioned of watering at the eyes, thirst, and palpitation, of nausea, or vomiting—symptoms which may be considered as among the most characteristic effects of arsenical poisoning. And yet it may be safely inferred from the history of a group of cases described by Dr. Elliotson in his published lectures (Lancet, May 5, 1832) that prolonged exposure to the emanations from large quantities of the poison collected in and about a dwelling-house may give rise to these symptoms. The following are the particulars of these cases:—A whole family was seized with nausea, and vomiting, and every one of them had watery eyes. They also complained of thirst, and of a sensation of heat at the stomach, and over the whole body. Their tongues, when examined, were found red and foul, and their pulses ranged from 120 to 160. The persons so affected consisted of the mistress of the house, four or five children, several maid servants, and a man servant. The children were all going about the house, and the servants were at their work. It was ascertained on inquiry that the nearest neighbours, and those who lived close by, were quite free from these symptoms, and the food was

Instructive cases reported by Dr. Elliotson.

A family severely affected by the emanations from arsenite of copper placed in a damp kitchen.

found to contain nothing which could account for them. The water also was examined by several eminent chemists, and found free from arsenic. But the persons who had lived in the house before had been mixers of colours, and before they quitted the house they deposited in the kitchen, and in the garden all round the house, a great quantity of arsenite of copper. Several barrels of it were removed. Before the discovery of the poison, Dr. Elliotson was convinced that the symptoms present in these persons were due to arsenic, and he had prescribed bleeding, which afforded relief to some of them ; but after the finding of the poison no medicine was prescribed. They all got perfectly well, except that pain in the limbs came on after they had all appeared well for some time. The house, it is added, was damp, and water had free access to the arsenic contained in the colouring matter. An eminent chemist, who was consulted by Dr. Elliotson, gave it as his opinion that this contact of moisture with the arsenite of copper led to the production of arseniuretted hydrogen gas, an opinion which is opposed, as was stated in the report of Professor Hofmann already quoted, to the results of positive experiment. Be this, however, as it may, the cases reported by Dr. Elliotson have obviously a most important bearing upon this inquiry, and for that reason the account of them is introduced in this place. They prove beyond a doubt the existence of a class of effects, due either to some unknown chemical reaction of moisture on the arsenite of copper, or to the diffusion of the poison itself through the air in an impalpable form ; and these effects are widely different from those which have just been described as being brought about by the handling of the poison, or its diffusion through the air as a fine perceptible powder. It is the group of symptoms thus described by Dr. Elliotson which we should expect to encounter in a modified and subdued form in persons who occupy rooms recently covered with paper-hangings stained by the arsenite of copper ; while we should naturally expect to encounter the symptoms previously described (the sneezing and itching of the nostrils, the rashes on the face, body, and scrotum, the slight headache, &c.) in those who handle and use the poison. But it would be only reasonable to expect that in those who follow this deleterious occupation for weeks and months together, so that the poison is being constantly introduced into the system by contact with the skin, and in the acts of respiration and deglutition, the constitutional symptoms developed in the cases reported by Dr. Elliotson would be superadded to the local symptoms experienced by men employed in the manufacture of the poison.

Bearing of these cases on the present inquiry.

Inferences from the same.

Some additional information bearing on this inquiry is also to be deduced from recorded histories of the effects produced by the aceto-arsenite of copper when taken directly into the stomach, whether intentionally or by accident, whether in large and fatal doses or in smaller quantities. The following fatal case occurred in King's College Hospital in 1858 :—A print-colourer swallowed an ounce of the green pigment, and died in seven hours. He did not vomit till an emetic was administered, and diarrhœa did not form a prominent symptom ; but there was slight tenderness at the pit of the stomach, and he was pale and faint, anxious and excited, and very thirsty. He had a small feeble pulse, and profuse cold sweats. He had severe cramps in the calves of the legs and in the hands, with twitchings of the legs and arms. He never rallied, and died exhausted. The tongue was tinged green, and the matters rejected from the stomach and bowels had the same colour. The stomach-pump was used, and the hydrated sesquioxide of iron given as an antidote. After death, the tongue retained its green tint ; the stomach contained a large quantity of the

A fatal case of poisoning by an ounce of the pigment swallowed by a suicide.

salt of iron speckled with green, its mucous coat and that of the small intestines was congested, the folds of the stomach were of a deep chocolate colour, and dots of extravasated blood were seen on its surface, especially near the pylorus. The lungs were greatly congested; the brain and kidneys sound. The symptoms and post-mortem appearances in this case were (with the exception of the characteristic green colour) such as we encounter in poisoning by arsenious acid itself; and we are, therefore, justified in inferring that this compound of arsenic is a very active and fatal poison when taken in the usual way. When swallowed in smaller quantity it also produces marked and sometimes fatal effects. Two fatal cases in children and one in an adult are recorded in Dr. Alfred Taylor's work on Poisons (2nd edit., pp. 431 and 432). The children had eaten a small quantity of a confectionery ornament coloured with the arsenite of copper. The quantity of the poison could not have been above two or three grains. The adult was a gentleman who partook of some blancmange to which a green colour had been given by this poisonous pigment. In these three fatal cases, as well as in nine cases that did not prove fatal, and in fourteen other cases reported to Dr. Taylor by Dr. Geoghegan, the symptoms were such as are produced by arsenic itself. There was a burning sensation in the throat, pain in the belly (sometimes described as colic), vomiting, purging, and intense thirst; a pale skin bedewed with a cold sweat, great depression, and a frequent pulse, and spasms in the extremities. Some of these symptoms are described as present in one case, some in others. In two or three of Dr. Geoghegan's group of fourteen cases jaundice showed itself—a symptom worthy of note, as affording a probability that in cases of poisoning by emerald green the copper constituent of the poison is not inactive. It is also worthy of remark that the irritation about the private parts, the rash on the same parts, and on others covered with hair, and the nasal irritation, ascertained to be produced by the emerald green, are also among the symptoms experienced by men who are exposed to the fine dust, consisting of brass in a state of minute division, which constitutes the imitation gilding employed by paper stainers, porcelain painters, ornamental printers, and others.

Fatal cases from swallowing smaller quantities of the poison in confectionery ornaments, &c.

Symptoms similar to those of poisoning by arsenic.

Jaundice an occasional symptom.

The copper constituent of the poison probably not inactive.

In the course of my investigation I have met with one case of accidental poisoning by the emerald green, which it may be well to introduce in this place. Mr. S. Pavy, my informant, saw the accident, and with his wife took the patient home, and was cognizant of the whole course of the symptoms. A toy, consisting of a wheel and a number of coloured revolving balls, happened to be broken in the street, and a boy $2\frac{1}{2}$ years of age picked up a ball painted with the poison, and sucked it. He was immediately seized with vomiting, and brought up green matter from his stomach. He was taken to a neighbouring chemist, who gave him an emetic, but no other medicine, nor was any other medicine subsequently administered. The sickness was followed by great drowsiness, and the child slept from the evening on which the accident occurred till 11 o'clock the next morning. The child recovered without any other bad symptoms. This symptom of drowsiness, too, is worthy of being borne in mind. It will be seen, bye and bye, that this is a common symptom among those who work with emerald green. Such accidents as these are, I have reason to believe, of very rare occurrence, for the proprietor of the large toy warehouse in Holborn, known as "Noah's Ark," informs me that in his long experience he has never known a complaint of injury arising from this cause; yet, a glance at the toys in his shop will serve to convince us that the

Case of poisoning by sucking a child's toy.

Drowsiness.

III. Industrial diseases.

1. Arsenic industry. By Dr. Guy.

emerald green is very often used to impart a lively and attractive colour to the larger kind of toys.

The facts already brought forward are sufficient to prove the virulent nature of this poison, as well as the many ways in which it may gain access to the system. They also pave the way for the further prosecution of this inquiry by indicating the variations to which the symptoms are subject—variations partly dependent on the form of the poison and the way in which it is introduced into the system, and partly on the constitution and state of health of the persons who are brought under its influence. What further remains to be said on the effects of the poison in those persons in whom it does not prove fatal may be conveniently arranged under the three distinct heads of—its action when swallowed; its action when inhaled in a state of impalpable powder; and its action when applied to the skin, swallowed, and inhaled in the course of certain well-known manufacturing processes.

The poison swallowed—
1. Intentionally by a suicide.
2. In pills given to procure abortion.
3. Ignorantly by children as paint used to colour toys.
4. In oil and water colours used by artists.
5. In green papers used as ornamental wrapping.
6. On artificial grapes.
7. In articles of confectionery.

a. The action of emerald green on the system when swallowed, either intentionally or by accident, has been sufficiently illustrated by the facts just stated. It will suffice for the purposes of the present inquiry to indicate briefly the several sources of danger to the public which are opened out by the use of this poison in the arts. In the first place, it may be taken (as in the instance already given) with the object of committing suicide; and Dr. Christison tells us that Dr. Duncan once detected it in pills given to procure abortion. Two cases of suicide by emerald green are also cited by M. A. Chevallier in his "Recherches sur les Dangers que présentent le Vert de Schweinfurt," published in the "Annales d'Hygiène," &c., Juillet 1859. A second possible source of danger to the public arises from the extensive use of the poison as paint. It is so used for ships and boats, for waggons and carts, and for shops, especially for the shops of publicans, bakers, greengrocers, and confectioners. Dr. Taylor (On Poisons, 2nd edit., p. 432,) states that several loaves of bread were supplied to him which had upon the under-crust a quantity of green pigment. On inquiry he found that the baker had recently painted the shelves of his shop with emerald-green paint, and that it had adhered to the hot loaves placed upon it. M. A. Chevallier also mentions an instance in which poisonous properties were communicated to strawberries kept in a basket painted with the emerald green. This green paint is also used by the makers of toys to render their wares attractive to children; and one case of poisoning (happily not a fatal one) from this cause has just been described. M. A. Chevallier, in the paper just quoted, especially condemns the employment of the emerald green paper in the construction of a toy called the "mirliton," which seems to be a sort of speaking trumpet. Manufacturers of artists' colours also make use of this attractive pigment both for oil and water colours; and Dr. Taylor (On Poisons, 2nd edit., p. 432) cites one case in which severe and dangerous symptoms of poisoning were produced in a child three years of age by swallowing a small capsule of the paint, and a second in which symptoms somewhat less severe were occasioned in a child a year old by eating several pieces of a cake of colour containing the same poison. Another source of danger to young children arises out of the extensive use of paper tinted with emerald green as an attractive lining for boxes of dried fruit, as a wrapping for cakes of chocolate, bonbons, and other confectionery, as the material of bags made to contain tapioca and other groceries, as a lining for cupboards and drawers, and as covers for tickets, boxes, and books. The window of a chocolate manufacturer in Holborn is at this time filled with packets of chocolate made up with this bright green paper, and there are few confectioners' shops in which for this purpose it is not more or less largely used. One case of poisoning through sucking slips of this paper came under the observation of the late Dr. Traill. The child, who was three years of age, suffered severely, but recovered. A similar case, in which a portion of the paper was eaten with the cake of chocolate of which it formed the wrapper, is given by M. A. Chevallier, and another in which the poison was sucked from a green ticket. Dr. Letheby, also, in his report on the case of Elizabeth Abdala, presently to be noticed, states that in November 1840 he was consulted in a case where one child died and another was made seriously ill from the effects of arsenical green from the paper of a cupboard where their toys were kept.

This pigment is also used to colour wafers, and in tinted envelopes; and the paper has been made up into matches to light pipes and cigars. M. A. Chevalier, in the paper already quoted, speaks of cases in which symptoms of arsenical poisoning were produced by burning old wall-papers. It is not to be doubted, also, that the extensive use of arsenite of copper in the production of artificial leaves, flowers, and fruits is attended with the risk of the poison being swallowed; and this risk, it would seem, is not confined to young children, for the girl Elizabeth Ann Abdala, on whose body an inquest was held in the month of October last, was 14 years of age. A companion of the girl gave her a bunch of artificial grapes, consisting of little globes of glass covered with emerald green. She saw her suck one of the grapes, a statement corroborated by the evidence of the mother. This took place soon after 9 o'clock in the evening of Sunday; she was taken ill at a quarter past 11 p.m., and died the following day at 1 o'clock. Mr. Chandler, a surgeon, was called to see her at 7 o'clock in the morning, and found her insensible. He thought her symptoms were those of poisoning, in which opinion Dr. Letheby coincided, stating that they corresponded exactly with what he had once seen as the narcotic effects of a small dose of arsenic. The body was examined, and the anterior wall of the larger end of the stomach was found to be perforated by an ulcer, about one-third of an inch in diameter, and designated by Dr. Letheby as a "chronic ulcer." There were also patches of inflammation the size of shillings and half-crowns close to the ulcer. No poison could be detected in the coats of the stomach, nor in the viscera submitted to analysis, with the exception of the gall bladder and a portion of the liver, in which "distinct traces of arsenic were discovered." On analysis ten grapes were found to be powdered with three grains of the poison, so that the single grape which the deceased seems to have sucked would only have contained about one-third of a grain. This minute quantity of the poison is obviously insufficient to account for the appearances in the stomach, or for the fatal symptoms. The case is not free from difficulty; but it serves, in any case, to illustrate the danger of using this poison in colouring artificial grapes. Lastly, confectioners and pastry-cooks, until a comparatively recent period, were in the habit of using the emerald green as a pigment; and instances are recorded of dangerous or fatal consequences occurring to young children from eating fragments of ornamental baskets made of sugar and gum, and coloured with the poison, or cake ornaments tinted in the same manner, or green sweetmeats, or (as in an instance reported to Dr. Christison by Mr. Ainley, of Bingley, in Yorkshire) apple tarts coloured with it; also of fatal consequences in the adult from the ignorant use of it as a colouring for blanc-mange. In this case, which occurred in 1848, the confectioner thought that the emerald green was merely an *extract of spinach.* I have reason to believe that the aceto-arsenite of copper is no longer used by respectable confectioners; but I have ascertained from colourmen that it is still sold in small quantities to the more ignorant or reckless manufacturers of confectionery and confectionery ornaments. The better class of English confectioners abstain from the use of mineral colours altogether, with perhaps the single exception of using a mixture of Prussian blue, gamboge, and sugar to impart a green colour of much darker tint and inferior brilliancy to that supplied by the mineral green. On the continent the emerald green has been used to colour bonbons. It was found in them in the shops of confectioners in Paris, in the years 1827 and 1829, being partly of native manufacture and partly imported from Germany. In England it does not seem to have been so employed, though other poisonous substances, such as minium, vermillion, chromate of lead, and camboge, have been detected in these sweetmeats.

Emerald green in paper-hangings.

b. That *emerald green, when diffused through the air as an impalpable powder*, or possibly in some modified form resulting from the action of water or moist air upon it, may give rise to very serious and well-marked indisposition, the group of cases already cited from Dr. Elliotson's lectures affords a convincing proof. And it must be obvious that if the same conditions which were present in that instance in the whole house were reproduced in a single apartment, similar consequences would follow, if not in all cases at least in some. Now these same conditions are certainly realized in apartments which have been recently papered with paper-hangings coloured with emerald green The poison has been shown to be present in such cases in very large quantity (28 to 70 grains to the square foot, according to Dr. Taylor), and the element of moisture is also present. Under this combination of circumstances we are certainly justified in expecting that the symptoms of arsenical poisoning would show themselves in those persons who occupy such rooms for many hours consecutively whether by day or night. Nor is it unreasonable to expect that in the absence of the element of moisture, poisonous effects may be produced by the gradual separation of the pigment from the surface of the paper, to which it is always loosely attached, and from which it is very easily removed. Nor would the occurrence of cases of a negative character in which no inconvenience was found to result from the occupation of such apartments suffice to throw doubt on the reality of cases in which positive effects are alleged to have been produced. The less free use of the colouring matter, or the partial employment of it, as in small leaves or buds of flowers, or, again the spaciousness and free ventilation of the apartments, may suffice to explain the absence of effect on persons fully susceptible of its action, while the want of susceptibility in the persons exposed to it may serve to explain other negative cases. Such negative cases have occurred in the experience of Dr. Taylor, who says that "there have been many cases in which the occupation of rooms thus papered has been attended with no injurious effects," (on Poisons, 2nd edit., p. 434), and I have myself known an instance of a spacious day and night nursery opening into each other, and covered with a flowered paper rich in emerald green, occupied for several months together by children and nurses, and yet without in any way affecting the health of the inmates. The poison in this instnace was so loosely attached that it deeply stained a white handkerchief rubbed over it. This negative instance is the more striking as it occurred in the house of a physician well acquainted with the effects of the poison, and quite alive to their detection. But, in spite of these negative cases, the evidence in favour of these arsenical wall-papers proving injurious in certain cases appears to me to be convincing. The cases brought before

Cases in which it has not proved injurious.

Cases in which it has proved injurious.

the Academy of Munich, and referred to by Prof. Hofmann, the decided opinion of Dr. Böcker of Bonn, as cited by Dr. Taylor in his work on Poisons, p. 435, and the case quoted by the same author (p. 433) on the authority of Dr. Martin, (in which case symptoms of arsenical poisoning were traced to the use of emerald green in oil-paint used to colour the walls of a low damp room) are sufficient to establish a very strong probability in favour of this view. This probability is converted into certainty by our English experience. It is sufficient to refer to the case of Dr. Hinds, confirmed by two other cases which came under his observation, and to that of Dr. Halley, (Taylor on Poisons, 2nd edit., pp. 365 and 435). In Dr. Hinds himself, the symptoms were nausea, pain in the abdomen, severe depression, and great prostration of strength, recurring on every evening that he occupied the room covered with the arsenical paper ; in his patients, thirst, heat and dryness of the throat, and loss of appetite, inflammation of the eyes, headache, and prostration of strength. Dr. Halley suffered from constant headache, dryness of the throat and tongue, with internal irritation, and, at the end of three weeks, complete prostration, and threatening paralysis of the left side. Specimens of the wall-paper used in these cases were brought to Dr. Taylor, and found to contain large quantities of arsenic.

A case of alleged poisoning by arsenical paper-hangings occurred as lately as the end of April 1862, and was the subject of an inquest. The deceased was the last of four children, who had died within a period of two months under exposure to the poison contained in the paper-hangings in the small proportion of three grains to the square foot. They had all been attacked in the same way, and had died of sore throat, which had been attributed to diphtheria. Mr. Thomas Orton, surgeon, did not hesitate to attribute the death to the poison. Dr. Letheby, who failed to detect poison in the stomach and viscera, said that the symptoms described by Mr. Orton were those of arsenical poison ; but the jury, after the coroner had expressed his dissent, maintained their verdict of "Natural Death." In the course of his evidence on this case Dr. Letheby stated that "he had known two children in Hackney die from arsenical poisoning imbibed while playing for a few hours daily in their father's library." The rare occurrence of fatal cases among artificial florists and others continuously exposed to the operation of the poison in large quantities for days, weeks, and even months together, as well as the subordinate place occupied by soreness of the throat among the effects of such exposure, combine to raise a doubt whether the fatal event in these cases could be attributable to the poison alone.

In the course of my inquiries I had occasion to visit, in search of information, a lady, who appears to have suffered from this form of exposure to an unusual degree. At my request she committed to writing the symptoms which she remembers to have experienced about ten years since, when occupying a sleeping-room in a house newly decorated and furnished. The walls were covered with a green paper, "the powder from which fell about her room, on books and pictures, to her very great annoyance ;" but the room was not damp. Her narrative was to the following effect :—Soon after sleeping in this room, she was attacked with sickness and diarrhœa every morning, the diarrhœa continuing till the middle of the day. These symptons continued for several weeks, in spite of strict attention to diet, and the use of tincture of rhubarb and other simple remedies, till one morning she awoke in great pain, with a spasm or cramp in her chest and stomach. A medical man was called in, who thought it necessary to visit her three or four times on that day. During the greater part of the day, she could neither sit nor lie, but rolled on the floor in agony. Towards evening, however, the pains abated, but she was left in a very weak state. The medical man continued to attend daily for some weeks, but she grew worse, and was at length sent to Worthing, where she quickly recovered. On her return to town she was again soon taken ill, but on leaving town for Hertford, she speedily recovered. The winter was now at hand, and she returned to her room in town. She was again taken ill, and this time much worse than before. Two medical men attended her for a long time. They prescribed nux vomica, which stopped the diarrhœa, but was followed by violent headache, twitchings, and swelling all over the body, with lameness in the right hip. Then she had two slight attacks, which the doctor called "warnings," of paralysis of the left side, one of which drew up her left heel. She was now quite lame, and continued so for many months; so that at last she was not expected to recover, and it was thought that if she did recover her health she would be obliged to walk on crutches for the rest of her life. She was then taken to Hastings; and after being there one or two weeks, was again thought to be dying; but under the care of Mr. Ranking, she soon improved in health, lost her diarrhœa, and in six months, through the local application of extract of belladonna, was quite cured of her lameness. During this residence at Hastings, she had several large boils, much of her hair turned quite white, and her teeth decayed very fast, and became so loose that two sound teeth dropped out. (Her teeth are now quite sound); the nails also grew to the skin on the tops of the fingers, and were painful when cut. Once more she returned to the house in town, and slept in the same room; but the symptoms returning, she left at once. To this account the lady adds that "all sorts of questions were asked about the house, with respect to drainage, &c., but the paper was never thought of;" and "these illnesses puzzled the doctor very much. He was most attentive, and most anxious to find out the cause."

I have given the details of this case, because I have no doubt that the several illnesses of this lady were caused by the exposure to the dust of the emerald green. At the same time, it ought to be remarked that though the symptoms experienced by this lady bore such a general resemblance to those present in the cases just referred to, especially in that of Dr. Halley, as to leave little doubt of the true cause, the case is complicated, and the real cause of some of the symptoms rendered obscure, by the exhibition of nux vomica, and the use of other active remedies.

I give the particulars of another case. The writer is the mother of the sufferer. She says:—"Wasting, and irritation of the stomach "were the most prominent symptoms. There was great disorder of "the digestive functions, flatulence, pains in the stomach and bowels, "loss of appetite, nausea, frequent attacks of vomiting and griping, "furred tongue, with dryness of the mouth and throat, quick small "pulse, oppressed respiration, with a dry cough; failure of strength, "an aversion to food and drink, a blanched complexion. In June "1861 we left home, hoping she might derive benefit from change of "air, but we were singularly unfortunate, having at Folkstone, Dover, "and Brighton green paper in our bedrooms. The symptoms were "the same everywhere. At that time we had no suspicion that the "green paper was in fault. My daughter suffered much the whole of "the winter and spring of 1862 in the same way. Last July we went "to Clifton, where we remained ten weeks. There was no return of "sickness, and her appetite improved most satisfactorily at that place. "We returned home in September, when immediately there was a "recurrence of all the symptoms. The paper was condemned, and "we left home once more for Clifton in November. In a few days "she appeared to be quite well, with the exception of the extreme "emaciation, and occasional breathlessness, and great delicacy. We "remained there another ten weeks. We have now been a fortnight "at home, and she has had no return of sickness. The paper has "been replaced by a white one. The workman who removed the old "paper was very ill the whole of the night and day after, exactly as "if he had had an attack of the cholera, with cramp, sickness, and "pain. The green paper was not what is called a flock paper, but a "glazed watered paper, covered with two shades of the most delicate "green. I also attribute a continued catarrh, with which I have "been plagued for some years, to the same cause, as it ceased at "Clifton, and I have had no return of it since I have not been exposed "to the same influence."

In this division of my subject I do not think it necessary to extend my inquiries.

c. The emerald green as applied to the skin, swallowed, and inhaled in the course of certain manufacturing processes.—This constitutes by far the most important section of the present inquiry. The process of manufacture has been shown to be of comparatively slight importance in its relation to the health of workmen ; the exposure to the fine particles or vapour of the poison in houses containing it or in rooms papered with it, though attended with inconvenience, is probably not productive of fatal effects ; and the swallowing of the poison, intentionally or by accident, though always a serious matter, and sometimes a fatal act, is still a rare event : but the manufacturing occupations in which emerald green is used are many, the persons employed numerous, and the effects produced often serious, and sometimes fatal. The men, women, and children employed in London alone in the four principal branches of manufacture—printing in colours, making the green paper sold for ornamental wrappings, &c., making paper-hangings, and making artificial leaves, flowers, seeds, and fruit—must certainly amount to several hundreds,* of whom some are employed for days, weeks, and even months without intermission, others only for short periods of a few days at a time. I shall give some account of each of these occupations, finishing with that in which the employment is most continuous, and the effects most serious,—I mean the manufacture of artificial leaves, flowers, seeds, and fruit.

Printing in colours.

Of the four distinct processes just specified, I take *printing in colours* first, as that in which the quantity of the emerald green employed is least considerable, and the exposure to the poison least continuous. The emerald green was first used in England for this purpose about the year 1846, by Mr. C. Kellow, then in business in Hatton Garden. He informs me that he applied the pigment by dusting (the process now in use), and employed for the purpose six boys to apply the colour, and six men to work the presses. Two of the boys were nearly constantly employed for a year and a half, and they received an addition to their pay of one shilling a week. Now and then they would leave their work for a week. The first symptoms which they experienced were dulness of the eyes and loss of appetite.

Introduced about the year 1846.

Mr. Kellow's statement.

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* By the census of 1851 it appears that at that date the artificial flower makers in Great Britain numbered 3,510, of whom 517 were males and 2,993 females. Of the whole number, 90 males and 1,452 females were under 20, and 427 males and 1,541 females above 20. The females above 20 years of age employed in London alone amounted to 975.

They also had a rash about the nose, face, and ears; and a running of matter from the nose. They were also affected in the private parts, the ulcers being at first mistaken for syphilis. One lad so affected was laid up for a fortnight. All the boys had a little fever and were thirsty. The pressmen were also affected. Mr. Kellow never knew any one to die of it, though he himself used it to a very great extent, to meet an urgent demand for it. He adopted the precaution of making the boys fleck the colour from the prints into a barrel with a moveable cover, and in the course of a fortnight or a month as much as two or three pounds of the pigment would be thus collected.

Establishment of Messrs. Day and Son.

In order to obtain more exact information upon this division of my subject I visited the establishment of Messrs. Day and Son, in Gate Street, Lincoln's Inn, where the process of chromo-lithography is carried on on a large scale, and where I enjoyed through the courtesy of the proprietors every facility for prosecuting my inquiries. The business is carried on in clean, spacious, and airy premises, and therefore under very favourable circumstances. The process is similar to that just described. The emerald green is dusted on to the moist chromo-lithographs previously printed with another less brilliant green, by means either of a piece of cotton wool, or of a camel's hair pencil, the excess of pigment being then brushed off by a larger and less compact brush. The dusting is done by boys, and the press-work by men. So that while this process is going forward, the boys, the pressmen, and other boys and men in the same room, but not at the time engaged in using the emerald, are exposed to the dust. The employment is an exceptional one, the emerald being only used when customers insist on the production of the very brightest green. The whole quantity used in the course of a year is estimated at less than twelve pounds. Among the men employed in this establishment there are some who have made no direct use of the pigment, but have merely been exposed to the inhalation of the dust diffused through the air of the spacious workrooms. One of these men informed me that in three hours or less he experienced tickling of the nose and sneezing, headache, and sore throat; but no bleeding at the nose and no rash. Another man similarly circumstanced stated that in three hours or so he experienced a tickling in the nostrils and a wish to sneeze, with slight symptoms of a cold. He also had bleeding at the nose, though not subject to that complaint, and little pimples made their appearance on the cheek and neck. He had no headache, but a feeling of depression. He stated that most of the men similarly exposed suffered in the same way. These cases are interesting, inasmuch as they afford a probability that persons who occupy rooms papered with hangings from which the pigment is readily detached, so as to float as a fine dust in the air, would suffer from similar symptoms. A higher degree of exposure to the dust of the poison takes place among the men who work the presses. From six men thus occupied I obtained the following statements:— One of them suffered in two or three hours from headache and soreness of the nose, but neither from bleeding at the nose nor from the rash. The second, in an hour, or an hour and a half, had running at the nose, and headache; but no bleeding at the nose and no rash, even after working continuously for three days. The third, after three or four hours, suffered from sneezing, soreness of the nostril inside, and dry throat. After three or four days a rash would appear about the nose and upper lip; but there was no bleeding of the nose and no headache. The fourth, on the second or third day, had dryness of the nostrils and upper lip, with slight bleeding from the nose, to which he is not subject. The fifth, in an hour or so, had the symptoms of a

The process.

Symptoms from exposure to the dust diffused through the air.

Symptoms among the men who work the presses.

common cold, and in three or four hours bleeding from the nose to the extent of half a cup-full, repeated two or three times in the day. There was soreness inside the nose, violent headache, and giddiness. He had no rash at any time, and he was not subject to bleeding at the nose. The sixth stated that in a quarter of an hour he suffered from headache, then from feverishness and dryness of the lips, then (towards the evening of the first day) from soreness of the nose. After the first day the nose was so swelled inside as to affect the breathing; but he had no bleeding from the nose and no rash. These cases, as well as those which are now to be noticed, serve to show the diversity of effects produced by similarity of exposure. The most direct and most serious exposure to the poison takes place, as has been just stated, in the boys who apply the dust directiy to the prints. They handle the poison to some extent, and the dust rises thickly about them. I now proceed to describe the effects produced by this more complete exposure to the action of the poison. My information was obtained from three youths, two of 14 and one of 17 years of age, and from seven men of ages varying from 23 to 36 years of age. The youth of 17 stated that he has dusted as many as four days together without experiencing any bad effects ; but that when working in the room where the process is going on he has had a slight soreness of nostril, but no bleeding from the nose. One of the lads, 14 years of age, stated that after about two days his nose and mouth become sore, his nose bleeds, runs with water, and seems stopped up. He has had no bleeding at the nose, and no rash. The other lad of 14 told me that he has dusted as much as five days together ; that on the second day all his food seems to have the same taste, that he is attacked with nausea and vomiting, that in the morning he gets his eyes open with difficulty and is very sleepy, that pimples come round his nose and mouth, and that his face is much swollen. His nose does not bleed, and he is not obliged to leave his work. The seven men whom I questioned described the effects produced by a more remote recollection of them. One man recollected bleeding at the nose, but nothing else ; another, at the end of two days, had swelling of the nose and itching of the nostril, with the symptoms of a cold, but no bleeding and no rash ; a third began to suffer within an hour with symptoms of a cold, with dryness of lip, and itching of the nose, and next morning with soreness of the nostrils and lips, and frightful headache ; but no bleeding and no rash. He was never laid up by it. He has the same symptoms now when the dusting is going on. In the fourth case the symptoms came on during the first day with soreness of the nose, sneezing, and running at the eyes, but no bleeding and no rash : in the fifth case they appeared in an hour or so, being at first those of a common cold, then, after a day or so, soreness of the mouth and nostrils, with small pimples round the mouth ; the nose was stopped up, but did not bleed. Headache was an early symptom. In the sixth case the symptoms appeared in three or four hours. They were those of a common cold. The nose was sore, the nostrils stopped up, and the breathing difficult. There was also headache, but no rash, and no bleeding of the nose. If the skin happened to be abraded the wound became inflamed. This man states that he has the same symptoms now when working at the press with the emerald green. In the last of this group of cases the symptoms set in on the first day, with pricking in the nose and irritation about the mouth and nostrils, with a dull pain in the head. He suffered also from colic and constipation, which he attributes to the poison. He had no bleeding at the nose, and no rash. He stated that he had experienced the same effects, though less in degree, when working in the same way with bronze.

Symptoms in the youths employed in dusting the poison.

Similar symptoms from working with bronze.

When visiting Messrs. Day's establishment, my attention was called to some printing in bronze going on in one of the rooms. The bronze powder was being rubbed over the lithographs, previously printed of a salmon colour. One of the men informed me that the bronze imparted to the collar of his shirt a dark blue tint, and he showed me a papular rash on the neck corresponding to the line of discoloration.

Examples of exaggerated statements.

Before I quit this part of my subject, I must refer to two cases which show the necessity that exists in all inquiries of this class, if not of rejecting all statements at second-hand, at least, of receiving them with caution and reserve. On one of the days when I visited Messrs. Day's establishment, I was told of a boy who had left it some time before through the severe effects of the poison. He was believed to have been laid up by it three weeks. I traced this lad to the stationer's where he is now at work, and obtained from him the following particulars :— He had several times been employed in dusting the emerald green. After about two hours he used to have a headache, soreness of the nose, and feverishness, but no bleeding and no rash. He worked at it as much as a week at a time, covering his mouth with a cloth ; but he was never laid up with it. He, too, had similar symptoms, but of less severity, when employed in dusting bronze. On the same visit a boy was pointed out to me who was alleged to have been laid up by the poison for three or four months ; but, on questioning him, I learnt that his illness commenced while he was dusting common ultramarine (a harmless pigment, consisting of silicate of alumina coloured by sulphide of sodium), and I ascertained from himself and his father that the medical man who attended him called the attack typhus fever. He was ill three or four months, and his fever was followed by dropsy. He came over very hot while at work. I have little doubt, from the description I received of his case, that it was one of severe infantile remittent fever.

Manufacture of green-tinted papers.

The manufacture of emerald green papers for ornamental uses.— This manufacture is largely carried on in London for the purpose of supplying the green paper so extensively used for show-cards, boxes, wrappers, labels, linings for drawers and cupboards, and other analogous purposes, among which I may specify, as most objectionable, its use as an ornamental wrapper to packets of chocolate and sweetmeats. In some establishments this paper is made by men, but in others young women or children are employed. The consumption of emerald green in the manufacture of this tinted paper is very large, and the quantity used for a single sheet, tinted on both sides, is stated to amount to as much as half an ounce. I caused a sheet of the paper, tinted on one side, to be weighed against a sheet of the white paper on which the colour is spread, and found the excess of weight to be exactly two drachms. As a small part only of this increase of weight is due to the size with which the colour is mixed, it is probable that the estimate given to me is near the truth.

My first experience in the effects of emerald green on the system was obtained from the cases of workmen engaged in this manufacture, and from a visit to the establishment in which they were employed. The following passage from my work on Forensic Medicine embodies the information thus obtained :—" Arsenite of copper mixed with warm " size is largely used in making tinted papers and for paper-hangings, " and is so laid on as to come into contact with the hands of the work- " men. After working one or two days the men begin to suffer, and " are soon obliged to abandon their employment. The first symptom " produced is a papular rash, running on to pustulation, about the " root of the nostrils ; the back of the ears, the bends of the elbows,

“ and the inside of the thighs, suffer in order, and then the scrotum, “ which is often found sprinkled with superficial circular ulcers, from “ the size of a split pea to that of a fourpenny piece, looking as if cut “ by a punch. Sometimes the fingers are inflamed, and the nails drop “ off. The pulse is sometimes increased in frequency, and occasionally “ the eyes smart and the epigastrium is tender. On abandoning the “ employment, the effects soon pass away; and they might certainly be “ avoided by scrupulous cleanliness and simple precautions to avoid “ contact with the poison.”

Process of manufacture.

I have renewed my acquaintance with the subject by visiting the workshop of Mr. Newbery, of Hemlock Court, Carey Street, where I was shown the process of manufacture, and was able to interrogate three of the men in his employ. The process differs from that employed by the lithographic printer, who uses the pigment as a fine dust in comparatively small quantity, while the manufacturer of tinted papers applies large quantities of it in a moist state. In the one case, therefore, the poison gains access to the system chiefly, though not exclusively, by the lungs, in the other case mainly by the skin. The process of manufacture of these tinted papers is very simple. The pigment is first mixed with warm size and water, either with a brush or with the hand. The hand is often used for this purpose to save time. The colouring matter is then rapidly spread over the surface of the paper with one brush, and as quickly brought to an even surface by a second. The paper is then hung up to dry, and, lastly, glazed by hot-pressing. The hand of the workman is, therefore, constantly in contact with the poison, and soon gets covered by it; and the poison is conveyed to the nose, mouth, and face by the natural movements of the hands towards those parts. In this way, also, it is probable that the irritation in the parts of generation, which has already been spoken of, and will have to be mentioned again, is partly brought about. A specimen of the tinted paper is annexed.

The poison introduced into the body chiefly through the skin.

Cases.

The following are the particulars of the cases of the three men employed by Mr. Newbery:—T. C., aged 40, has worked in the business for 30 years, and has used emerald green as much as 25 years. He usually works with it two or three days at a time, but, on one occasion used it every day for a fortnight. After working with it about three minutes, he begins to suffer from stinging in the face, running at the nose, and sneezing. These symptoms increase in severity, and on the next day the face gets red and the skin cracks, and it feels as if it had been burnt. After a variable interval of one, two, or three days, sores make their appearance, sometimes on the bend of the arm, sometimes on the face, sometimes on the back of the neck. It is at first a large red patch, and then a running sore. On one occasion, at the end of the first day, the face was so swollen that the cheeks were on a level with the nose. This swelling was attended with intolerable smarting. The nose gets stopped up, and bleeds. Sometimes he suffers from a severe headache, sometimes from pains in the bowels, but without constipation or diarrhœa, sometimes from nausea, but no vomiting. He has never felt drowsy with it, or had palpitation. The flesh is sometimes eaten from the nails. When he continues at the work for some time, a rash shows itself on the groin, and on the penis and scrotum. He says that the suffering produced by the poison is very great, but that he has never been laid up with it. T. R., aged 35, has been employed in the business 10 years, and has occasionally used the emerald green. He is seized almost directly with running at the nose, sneezing, and itching, and dimness of sight, and a universal feeling of discomfort. After the work is over he is seized with trembling, with great prostration, and a sense of extreme discomfort, but no palpitation and no

drowsiness. Once, after working for three days, he was laid up with "tremendous" swelling on the left side of the face; the nose was swollen and stuffed up, but it did not bleed; and he had sores at the bends of the arms, and on the pudenda. This man states that while the work is going on every person employed in the same room is affected by the poison. He has worked with bronze powder, and has had the same symptoms, but less severe. They do not appear so soon. It, too, causes a rash on parts covered with hair. R. L., aged 55, has worked in the trade 40 years, and occasionally uses the emerald green. After about half an hour he has tingling of the face, with running at the nose and sneezing, as if from a cold. His nose gets stopped up, but does not bleed. In the course of the first day the symptoms of cold increase, and he suffers from headache and a feeling of depression. The next day a rash appears on the bend of the arms, in the armpits, and on the nose, face, forehead, and back of the neck. Sometimes, after a day or two, the private parts are attacked. The effects pass off in two or three days.

Dr. Prosper de Pietra Santa, in a paper published in the 10th volume of the "Annales d'Hygiène" (p. 339, new series, year 1858,) gives a minute account of the manufacture of green tissue paper for the construction of shades, balloons, and lanterns, as carried on at the prison of the Madelonnettes. The workmen suffer from the symptoms just described.

Paper-hangings. Process of manufacture.

The use of emerald green in the manufacture of paper-hangings.— This manufacture, as I saw it carried on in the establishment of Hennell and Co., 172, Southwark Bridge Road, bears a near resemblance to the making of tinted papers. The emerald green, sometimes neat, but more generally mixed with whiting, is suspended in warm water containing size, and then quickly spread over the surface of the paper by means of large circular brushes. The paper so prepared is then hung up to dry, and on this tinted ground the pattern, if required, is printed by wooden blocks, on which the figure is raised by copper wire; or, if a flock paper is required, the flock is dusted on to a pattern printed in oil colour. The papers are finished by hot-pressing. By this process it will be seen that the hands of the workmen are coated with the pigment, which, as in the making of tinted papers, is carried to the nostrils, mouth, face, and other exposed parts of the person. But the quantity of the dust floating in the air appears to be small, owing, as it is believed, to the use of a stronger size than is employed for the tinted papers. The quantity of the dust detached from the paper is, however, represented to be much greater in manufactories which print by machinery, where, as a general rule, the quantity of size employed is less, and the process of manufacture much more rapid. A specimen of a figured paper manufactured by machinery is annexed. For the reason just stated (the use of a stronger size and the consequent greater tenacity of the pigment), the effects produced upon the workmen are less marked. This will be made sufficiently apparent by the two cases subjoined. F. W., aged 52, has worked in his present place 22 years, and has been employed laying on the emerald green sometimes as much as six weeks at a stretch. It generally takes some effect upon him, but not always. After using it constantly for about three days, he begins to suffer with slight itching of the face, and the symptoms of a common cold; then, sometimes after two or three days more, a rash appears on the face, and at the bends of the arms, and of other joints. Once only he suffered in the private parts for a day or so, but not badly. He has had an emerald green paper in his own room, but neither he nor his wife and children suffered from it. G. L., aged

Cases.

41, has been in the business 25 years, and in his present situation eight years ; and has worked with emerald green (neat emerald, *i.e.*, the unmixed pigment) as much as a month or two at a time. In one or two days he begins to feel the effects of it, in the form of itching and running at the nose, with occasional sneezing, and a slight rash on the face. No rash appears on other parts of the body, and none on the private parts. He knows many men in the trade, but never knew a man laid by for a day through the use of the emerald. He sometimes makes use of bronzing, and it affects him in "exactly the same way."

In this establishment I was informed that the demand for emerald green papers is much less than it was three years ago, and that the quantity they now use does not exceed about half a ton in the year.

Messrs. Nind, of Beech Street, Barbican, confirmed these statements. They informed me that in the papers made by hand the emerald green is more firmly attached to the surface of the paper than in the papers made by machinery. In the former, size or gum is used ; in the latter, potato-water. They added that their consumption of emerald green has fallen from about a ton in the year to about three cwt., and that they take the precaution of stamping the letters N A on all green papers not coloured with arsenical pigment. The Messrs. Nind are very largely employed in the decoration of hotels and other large establishments, and they allege that no instance of bad effects from occupying rooms covered with arsenical papers has been brought under their notice. They also represent the effects on the paper-hangers of using the emerald green papers as very severe. In cutting off the edges of the paper, the dust of the pigment is largely diffused through the air, and the men cannot prudently continue at their work more than two days. They suffer from shortness of breath and the symptoms of a severe cold, followed in some cases by the rash. I have also met with one instance of severe effects produced in the person of a workman employed in removing an emerald green paper ; and another instance, in which the workman employed in cleaning the paper of a confectioner's shop, and all the persons serving in the shop, suffered from itching of the nostrils, sneezing, watering at the eyes, and the other symptoms of a cold.

The manufacture of artificial leaves, flowers, seeds, and fruit.

The use of emerald green in the manufacture of artificial leaves, flowers, seeds, and fruit.—I have now arrived at the most important branch of this inquiry. Up to this point I have had to speak of serious inconvenience and suffering occasioned by the use of emerald green in the arts, and occasionally of illnesses of some duration and severity. I have now to examine into the particulars of an occupation which has in more than one instance been charged with leading to fatal consequences. As one of the alleged fatal cases occurred in the practice of Mr. Paul, surgeon, of Burton Crescent, who was called upon to give evidence before the coroner's jury, I addressed myself, in the first instance, to him, and obtained some particulars of the fatal event which I shall presently have occasion to describe. But in the meantime I propose to speak of cases that have not proved fatal, and shall begin with the information respecting them for which I am indebted to the courtesy of that gentleman. He informed me that he had at different times been called upon to prescribe for as many as 50 young women employed chiefly in the establishment of Mr. Bergeron. He described them as suffering from tenderness at the pit of the stomach, and vomiting of food, with excessive thirst, and extreme weakness ; also with a rash more or less severe and extensive. In some of the cases there was diarrhœa ; in others constipation. The tongue was white and flabby, and the complexion that of chlorosis. Pain in the left side

Evidence of Mr. Paul, Surgeon of Burton Crescent.

was a very common complaint. The vomited matters had a greenish tint, and the patients said that everything they looked at appeared to have the same colour. Many patients seemed as if suffering from an attack of fever; and one case seen by a physician in consultation with Mr. Paul was assumed to be a case of fever, and sent to the Fever Hospital. He does not doubt that the symptoms described by him were traceable to the action of the poison. It may be well to add that the patients were mostly young women about 20 years of age, a time of life at which infantile remittent fever does not prevail. Mr. Paul had a very bad case (not from Mr. Bergeron's establishment), which continued under his care for two months, and two or three other bad cases, which he treated by the sesquioxide of iron.

Cases.

Having heard from Mr. Paul that my friend Dr. Maurice Davis of Brunswick Square had been consulted in some of these cases, I called upon him, and obtained a general confirmation of the statements made by Mr. Paul. Dr. Davis also obligingly sent to me one Margaret Stennett, whose daughters had been severe sufferers by the use of the emerald green. She informed me that her twin daughters, girls of 17 years of age, had been working for Messrs. Cliplow and Martin of Argyll Square, where about 200 young women are employed. They had worked with emerald green three days in the week for about seven weeks together, when they became so ill as to be obliged to abandon their employment. After the first three days they both had sneezing and running at the eyes, as if they were crying, and a green fluid came from their nostrils. One of them vomited once, and brought up matters of a green colour. They lost their appetite, and were out of health. The next week they had the rash at the back of the head. The rash increased week by week, coming first in pimples, and then ripening like the small-pox. At the end of the seven weeks she consulted Dr. Maurice Davis, who recommended her to take her daughters away. One of them, on being removed, had a febrile attack, beginning in the morning with a white tongue, and a rash over the whole body like the scarlet fever. She thought that it was scarlet fever. In this feverish state she continued for several days, and the skin then peeled off. She recovered slowly, and went to work again after the lapse of about a week from her recovery. On visiting this establishment I found that the proprietors adopted the sensible precaution of allowing their hands to work with the emerald green only on alternate days. Having obtained this preliminary information, I visited the establishment of Mr. Bergeron, where every facility was afforded me of obtaining the information I sought. The business of Mr. Bergeron was formerly carried on in small, inconvenient premises at 73, 74, Judd Street, but is now removed to Essex Street, Islington, where the workrooms are exceedingly spacious and convenient. About 100 young women were at work in a long room, light and airy, chiefly engaged in the manufacture of artificial leaves. They also make artificial grapes and fruit, but no flowers, these being made in other establishments, where the leaves purchased of Mr. Bergeron are made up with the flowers and fruit into wreaths. The use of emerald green is now much restricted, partly through change of fashion, partly from diminished demand, and partly through disinclination on the part of employers and employed to work with the poison.

The manufacture as carried on in Mr. Bergeron's establishment.

There are three principal processes in use. The first consists in brushing the pigment, made into a thin paste with gum-water, on to the leaves, cut to shape from sheets of muslin, and embossed in a press; the second, in dusting the pigment on to the leaf or fruit previously dipped in melting wax; the third, in cutting and embossing, by means

Processes of manufacture.

The moist process.

The dry process.

Green grapes.

"Waxed" and "fluffed" leaves.

The fluffing process most injurious.

Precaution.—The use of towels.

of dies, several layers of muslin previously coloured by emerald green, applied nearly in the same manner as in the manufacture of the tinted papers. It is by the second process that the green grapes are made. The little glass bulbs are dipped in gum-water, and then powdered or dusted. The pigment is dusted on to the leaves through a littel muslin bag, but in the work-rooms of Mr. Nicolas, of Chiswell Street, the emerald green is applied to the leaves dipped in wax by a teaspoon, which method has the advantage of causing but little dust. The leaves so dusted, as well as those prepared by the first and third processes, are, in some cases, dipped into melting wax, in others left untouched. The first are known as "waxed leaves," the others as "fluffed leaves." In some cases a shining surface is given to the leaf by dusting it a second time with powdered glass. It will be seen, then, that in the manufacture of artificial leaves, two processes are employed which resemble that in use among the manufacturers of tinted paper and of paper-hangings; and another process which resembles that in use among chromo-lithographers. It is against the dusting, or "fluffing" process that the most serious objections are urged. It may be added that the waxed leaves are comparatively free from objection, as the process of waxing protects the poison completely, and prevents it from being detached, while the unwaxed leaves allow it to be easily shaken or rubbed off. The manufacture, making up, and use as ornaments of these unwaxed leaves are therefore alike open to objection. Before I proceed to describe the effects of this dusting process, I may state that it is usual to protect the mouth and nostrils by means of two twisted towels fastened round the face. But some women dispense with this precaution. It is of very partial efficacy, for though it prevents the poison from settling on the lower part of the face, it cannot exclude it from the system, for the air which must be inhaled by mouth or nostril, or both, contains the dust, and such advantage as arises from its partial exclusion is likely to be counteracted by the warmth produced by the passage of the breath. Accordingly, I have heard this precaution condemned by several men employed in other trades as worse than useless. Some young women adopt the preferable plan of protecting the whole lower part of the face by raising their aprons, and fastening them at the back of the head.

General impressions respecting the bad effects of the employment.

Before proceeding to ascertain the effects of the poison by questions addressed to individual sufferers, I convinced myself by general inquiries that it is a matter of notoriety in Mr. Bergeron's establishment that the use of the poison is productive of serious consequences, and that the young women speak with confidence of at least two fatal cases. I may add that there are very few cases of exemption from attack; but that some are known to suffer more speedily and more severely than others.

Plan of the inquiry.

In prosecuting this part of my inquiry, I adopted the following plan. I first requested the intelligent forewoman, to whom I was indebted for much valuable aid and information, to select for me a few of the young women then at work who were known to have suffered most severely, that I might take their account of the effects produced directly from themselves; also such others as had the rash or other marks of injury upon their persons; then to select a group of 25 girls who had suffered more or less severely, that I might address to all of them the same questions, and thus compile an account of the principal symptoms. I then completed my inquiry by addressing to her such questions as my previous examinations had suggested.

Cases.

The following are the particulars of the cases of the young women selected as being among the greatest sufferers:—J. C., aged 20, has been in the business nine years. She always covers her mouth and nostrils with the cloths when at work with the emerald green. After working for a day or two, she is attacked with symptoms of a severe cold, attended by great pain in the head, side, and back, and followed by nausea. Nervous trembling soon comes on, so that it is not possible to hold things steady; and at night she feels very sleepy. She does not bleed at the nose. Even on the first day small pimples come out on the back of the neck, on the lips and face, at the parting of the hair, behind the ears, and at the bend of the arms. She was once laid up for three months in bed, with pain in the stomach and head. There was a heavy sensation, as well as great pain in the head through the whole illness, and dreadful nervousness. This illness happened about six months ago. Among the effects of the poison were great soreness of the nails, and "gatherings" in the fingers. She is sure that her illness was caused by the poison, and her medical man said so. M. A. W., aged 22, has worked in this establishment one year and nine months, and has dusted the emerald green, using the towels as a protection. In half an hour, or so, she has the symptoms of a common cold, with nausea and pains in the stomach, but no vomiting. On getting up in the morning, however, she has been sick, and she suffers from pain in the head, and a general feeling of illness and languor. She has had bleeding from the nose. Palpitation and shortness of breath, drowsiness in the morning, and weakness and trembling of the hands are among the symptoms. On one occasion she was confined to her bed for seven weeks; and she and her medical attendant attributed the illness wholly to the poison. She then suffered from retching and vomiting, with diarrhœa and great pain in the stomach, and excessive prostration. The poison sometimes causes diarrhœa, sometimes constipation. With her the rash would appear within the first week on the face and neck, on the hair, and at the bend of the arms. The fingers also were sore. A. P., aged 25, has worked at Mr. Bergeron's some years, and continuously with the emerald green for 12 months. After the first three days she was laid up for a week, and this has happened several times since, her longest absence from work having been two weeks. After working with the poison for one or two days, she feels faint and sick, and after another day or so is seized with dreadful running at the nose and eyes, and sneezing. Sometimes she has had gatherings within the nose, which seemed to break and bleed. Her breath is very short, her heart beats, and she is very nervous. In about a week a rash appears on the face and neck. Sometimes she suffers from small gatherings about the roots of the nails and between the fingers. But she has no sores at the back of the neck, behind the ears, or at the bend of the arms. She does not suffer in this way so much as others, but the face has been very bad. Thirst is one of the common symptoms. When she was laid up, she had great pain in the side, shortness of breath, palpitation, profuse perspiration, and intense thirst. She also suffered much from headache. But she had no convulsive twitchings. She was very weak, and had heats, flushes, and great restlessness, with pain in the chest and loss of appetite; but she slept as usual. Though she was employed in dusting, she did not use the towels.

Among the young women who were suffering from the poison at the time of my visit, some had the rash on the face, at the back of the neck, or behind the ears, others at the bend of the arms; some had sores at the roots of the nails and on the fingers; one had an open sore on the right leg, and another on the foot, a third on the left side, as a sequel of the rash. One young woman, who had lately left the establishment, had lost the whole of her hair from the top of the head, in which situation an open sore had formed. The rash in the cases which I examined had every variety of appearance, from clusters of pimples to clusters of pustules, and open sores without any distinct character. The sores themselves had a dark colour and unhealthy appearance. They may be described as sloughing ulcers. In one girl an ulcer had completely eaten through the fleshy part of the base of the ring finger, so as to form a dark unhealthy sinus. In more than one instance scars were shown to me similar to those left after the rubbing in of tartar-emetic ointment, and it is not uncommon to find them presenting the appearance left by an attack of small-pox. Most of the appearances presented by the arsenical rash are faithfully portrayed by M. le Dr. Vernois in a paper published in the "Annales d'Hygiène" for the year 1859, p. 346. He describes the rash as appearing under many forms ; as a diffuse erythema, as small and crowded vesicles, as papules which grow flatter and wider by contact with an opposed portion of skin, and lastly, as pustules running into ulceration and gangrene. These several forms of rash are shown in coloured lithograph on the parts of the body commonly affected, as are also the ulcers at the ends of the fingers. But the peculiar and highly characteristic appearance of the ulcers on the scrotum, as I have seen them, is not shown. The appearance in question consists of small shallow ulcers, with even surface and thin soft edge, barely moistened with a light yellow discharge, perfectly circular, as if cut out by a sharp round punch, penetrating through the skin, and no further. It is such ulcers as these which, forming on the face and other parts of the body, leave the circular scars so similar to those of small-pox. The inquiries which I addressed to the forewoman of the factory elicited the following additional items of information. She stated that a loss of voice was a not uncommon symptom ; that bleeding of the nose was of frequent occurrence ; that the complexion is usually changed to a dusky yellow or olive ; that watering at the eyes becomes habitual in some cases after the use of the poison has been discontinued ; that dysuria and dysmenorrhœa are frequent, and that the urine assumes a green hue. She also stated, as a fact within her own observation, that the infants of the workers in emerald green are sometimes born of a dark colour, and that one infant had a sore on the under lip, and sores also on the fingers and toes. She further informed me that the rash makes its appearance even on parts closely covered by the dress, as, for instance, on the bend of the arm in those who wear tight-fitting sleeves ; that it sometimes closely resembles the eruption in scarlet fever, and is attended with intense itching ; and that when it has once shown itself, it is apt to return when the body is heated, though the work has been laid aside. In answer to inquiries which my previous information obtained among men working with the poison prompted me to make, I learnt that the effects of the poison extend to the *pudenda*, and that in several cases the lower part of the body has been so severely affected that the young women are unable to sit down. One of the worst cases of this sort occurred in a girl employed to sweep the workroom.

Distressing local effects of the poison.

I brought my inquiry at Mr. Bergeron's to a close by addressing to 25 of the young women who had worked with the emerald green, and suffered from it, a series of questions. These questions were suggested by my experience of the effects of the poison as acquired partly at this establishment, and partly at other places which I had visited ; and they constituted, so to speak, the sum of the knowledge I had already obtained. Out of the 25 young women thus interrogated, 11 had been laid up for longer or shorter periods ; one for nine weeks, two for

Catarrhal symptoms.
The rash.
Symptoms affecting the alimentary canal.
Thirst.
Nausea and loss of appetite.
Sickness and vomiting.
Pain in the stomach.
Symptoms affecting the circulation and respiration.
Pain in the side.
Palpitation.
Dyspnœa.
Constitutional symptoms.
Debility.
Fever.
Headache.
Dimness of sight.
Drowsiness.
Tremblings and convulsiv twitchings.

three weeks, two for two weeks, one for nine days, five for two, three, or four days. Of these latter two had been laid up several times. The girl who had been laid up nine weeks had been at work from day to day for 12 months. Of the two that had been laid up several times, one stated that she could not continue at the work more than three days, and another girl stated that once, after working for one day and a half, she was laid up for the same period. The whole number, with only two exceptions, stated that they suffered from the symptoms of a common cold, and in two of them they were extremely severe. The whole number too, with a solitary exception, had had the characteristic rash on the skin, and nine only had not suffered from sores on the fingers. The symptoms which have reference to the functions of the alimentary canal are thirst, nausea and loss of appetite, vomiting, and pain in the stomach. The symptom of thirst, so common in cases of poisoning by arsenic and by the irritant poisons generally, was present in the whole of this group, with only two exceptions, and out of these 23 cases, in which the symptom was present, there were only two in which it was not described as excessive. To the symptom of nausea and loss of appetite there were also but two exceptions, and in one of these the appetite was said to be increased. In five instances the loss of appetite was complete. There were only two cases, again, in which there was no sickness. This symptom was generally described as occurring in the morning, and in no less than 13 cases it was carried to a painful extent. In one of these cases it would occur even in the street. Pain in the stomach was the least common symptom of this group. It was present in 12 and absent in 13 cases; and in three of the 13 it was described as very severe. Of the symptoms affecting the functions of circulation and respiration, namely, pain in the left side, palpitation, and shortness of breath, the first (pain in the side) was present in 20 cases, and very acute in seven instances; the second (palpitation) was present in 14 cases, and in six of these in a very distressing degree; the third (shortness of breath) was present in 21 cases, and in five of these in an intense degree. The remaining symptoms belong to that more general order known as constitutional symptoms. They are debility, fever, headache, drowsiness, dimness of sight, and tremblings, nervous twitchings, or convulsions. Of the whole group of 25 females, four only did not complain of weakness; and of the remaining 21, there were again only four who did not describe the weakness as extreme. Febrile symptoms were present in no less than 20 cases, in five of which they amounted to feverishness, while in the remainder they were described as fever. Headache, again, was an almost universal symptom. It was absent in two cases only, and was described as not severe in only three cases. Dimness of sight was complained of in two-thirds of the cases. In one the eyes were very sore, in another the sight was greatly impaired. Drowsiness was present as a marked symptom in every instance but one, and in two cases only was it spoken of as a trivial circumstance. Tremblings and convulsive twitchings were present in seven cases out of the 25, and in one other instance well-marked convulsions were present.

Parts attacked by the rash.
The neck.
The face.
The ears.
The head.

In reply to questions concerning the parts affected by the rash, the following information was obtained. The most common seat of the rash was the neck, about the roots of the hair. It occupied that spot in 24 out of the 25 cases; in one of these cases it was stated to be slight, in four very severe. In 22 cases out of the 25 it attacked the face, and in two of the cases only in a slight degree. In 15 instances it appeared behind the ears, in one only slightly, in one other with severity. In nine cases it attacked the head, in six it appeared at the bend of the

The arms.

The *pudenda*.

arms, and in one case "elsewhere," and that in a very severe form. This history of the rash would be incomplete but for the information obtained from the forewoman respecting its frequent appearance on the *pudenda.* I ought also to add that in two of my respondents the rash was visible on the neck, and in three of them white scars (in two on the neck, and in one on the nostril) indicated the parts formerly attacked by it.

In this establishment of Mr. Bergeron, and in other similar establishments on a large scale, the work of the young women is directly superintended and directed by intelligent forewomen ; but in smaller establishments the men and women are not separated from each other ; they work in the same rooms, and follow their occupation for weeks or months together in the same way. In these smaller workshops we occasionally encounter men who have suffered severely from the use of the emerald green. One M. P., a Frenchman, working in Goswell Road, stated to me that after working incessantly for three months at the fluffing process he was laid up for three weeks with a swollen face, the characteristic rash, extreme soreness of the scrotum, occasioning great difficulty in walking, trembling, fever, and thirst. He attributed his recovery to the use of the vapour bath.

There is a branch of manufacture which, being carried on upon a comparatively small scale, I have not thought it necessary to investigate very narrowly, but which still deserves a brief notice. It is the staining of real grasses with emerald green and other light colours. The pigment is usually mixed with starch and water, into which the grass is dipped and then hung up to dry. The poison is very readily detached ; and, therefore, this is to be regarded as among the most objectionable products of industry. A Frenchman whom I found employed in this way had the rash upon his face, which could excite no surprise, seeing that he was more than usually unobservant of the rules of cleanliness.

2. *Alleged Fatal Cases.*

Method of procedure in conducting this inquiry.

I have now arrived at the most important as well as the most difficult part of this inquiry. I have to apply myself to a question, often very hard of solution, whether, in certain specified cases, death has been rightly attributed to a certain cause. Dr. Hillier's report alludes distinctly to two fatal cases which had occurred at an interval of not many months in Mr. Bergeron's establishment for the manufacture of artificial leaves, fruit, and seeds ; while the letter of the secretaries of the Ladies' Sanitary Association refers not only to the fatal case of Matilda Scheurer, but also to other instances in which death had been attributed to the same cause. A perusal of these letters at once pointed out to me my proper course of procedure. I would begin my inquiry by visiting the establishment where the two deaths spoken of by Dr. Hillier had occurred, and having obtained all the information which the persons employed on the spot could afford me, I would place myself in communication with such other persons as might be able to complete my knowledge of the facts. As soon as I should succeed in satisfying myself of the true cause of death in these two cases, I would make diligent inquiry after other alleged fatal instances.

I will begin by repeating what I have already stated respecting the facilities for inquiry afforded me at Mr. Bergeron's establishment. I had all the assistance I could require from Mr. Bergeron himself, and from the intelligent forewoman who presides over the workshop and directs the details of the manufacture. From her I ascertained that it was commonly believed in the establishment that two young women had died from the poison. The name of the one was Frances Rollo, that of the other Matilda Scheurer. Of the cause of death in the case of Frances Rollo some doubt was expressed, as she was believed to have been sickly from causes other than the use of the poison; but there was no misgiving in any mind as to the death of Matilda Scheurer having been caused by her occupation, and by that only. The account which I received of the case of Frances Rollo from the forewoman, and from young women who had worked with her, was to the following effect:—She was 17 years of age, and had worked in the factory about a year and a half. She was quite well when she began. She worked with the emerald green day by day for six months. She fell ill, and wasted away gradually. She had all the usual symptoms, and before she left work a hole formed in the base of the left ring-finger, a part on which the poison settles in dusting. She also had the same rash as the others. Her neck was very bad with sores, and was covered with a complete crust. She was at work on a Saturday, and left work on the Monday following, when she took to her bed. Her symptoms were those of fever, for which Dr. Maurice Davis attended her. Before her fatal illness her symptoms, as just stated, were those of the other girls, but more decided. She was pale, her complexion assumed a sort of dusky yellow tinge, and she grew very thin. She was not worse fed or less cleanly than others. She was sent to the London Fever Hospital, where she died, May 20, 1861. The body was examined, but no inquest was held. The gate-porter was reported to have said that the liver was found full of holes. From Dr. Maurice Davis, who is referred to in the foregoing account, I ascertained that Frances Rollo had been seen by him, and found to be suffering from symptoms of fever, which justified him in recommending her to be sent to the Fever Hospital, and from Mr. George Reed, the resident surgeon of that institution, I received, in reply to a letter of inquiry, the statement that "Frances Rollo was admitted on the 18th May," but although a note was taken "of the fact of her having been employed as an artificial "flower maker, there were no symptoms which could specially be "referred to that cause; indeed, she was not sufficiently conscious to "give any account whatever of her illness. The day after her "admission she was quite insensible, with a pulse of 130, very weak, "and the pupils contracted and insensible to light. The bowels were "confined, and had been so for some time previously. She died 36 "hours after admission." Mr. Reed adds, "I have no note of the "post-mortem, but I remember making it, and on referring to the "register find the cause of death is marked acute valvular disease of "heart, hydatids of liver, and morbus Brightii. The friends, I have "no doubt, received some imperfect account from the hospital porter "which led them to believe there was an abscess in the liver." I shall have some observations to make on the true cause of death in this case when I have given the particulars of the illness and death of Matilda Scheurer.

Case of Frances Rollo.
Six months continuous work with the poison.
The usual symptoms well marked.
Sent to the Fever Hospital.
Symptoms on admission.
Post-mortem appearances. Disease of the heart, liver, and kidneys.

The following particulars of this case were taken down from the lips of A. P., a fellow-workwoman of hers in the establishment of Mr. Bergeron. A. P. was with the deceased during her last illness, and at her death, which took place Nov. 20, 1861. She was attended by Mr. Paul of Burton Crescent; and a coroner's inquest was held upon the body. The verdict was "Death by arsenite of copper." A. P. added the following particulars, which she gave as one who had a vivid and accurate recollection of all the facts. The deceased was 19 years of age. She had worked for Mr. Bergeron several years, and had used the emerald green, day by day for 18 months. She was quite

Case of Matilda Scheurer. Statement of A. P.
Eighteen months' continuous use of the poison.

Symptoms.

well when she began to use it. She first complained of pain in the side and in the inside, and she had retchings of a morning, when she brought up a liquid of a greenish cast. She had not so much rash as most others have. She grew thin, her eyes looked heavy, and her complexion changed to a yellowish tint. She fell seriously ill on a Friday, and died the following Wednesday. On leaving the shop she took to her bed, complaining of loss of appetite, great thirst, and pain in her side, vomited often, and brought up a greenish coloured water. She also said that she had no feeling in the head. She had no rash. She was very thin. There was no diarrhœa. She complained of violent palpitation and shortness of breath, and of great feverishness and restlessness. She had no sleep night or day, and the composing draughts ordered for her failed to give her rest. From four in the morning till half-past 11, when she died, she had convulsions every few minutes, with foaming at the mouth, and at last running from the nose, eyes, and mouth. She had the convulsions up to the last. After 8 o'clock she knew no one, and seemed to have lost her sight. After obtaining this information (which corresponded with that subsequently obtained from the sister of the deceased), I called on Mr. Paul of Burton Crescent, and ascertained from him that he had attended the deceased in her last illness. He confirmed the account just given of the occurrence of convulsions, and obligingly placed at my disposal the notes of the case which he had taken down from day to day. From these notes I have compiled a short history of the case, which, it will be seen, confirms in every essential particular that which I obtained at Mr. Bergeron's establishment. She had worked at the emerald green about 20 months, and during the whole of that time suffered from eruptions about the neck, scalp, and hands, accompanied by pains in the nose with the common symptoms of a cold, great pain in the left side, frequent vomiting of food, and intense thirst. She was first seen by Mr. Paul on the 15th of November. She was in bed, breathing laboriously, and complaining chiefly of the pain in the side and frightful thirst. The countenance wore an expression of great anxiety, and the conjunctiva had a peculiar green tint. The pulse was about 120, and very small. The tongue was dry, brown down the centre and green on each side. The vomited matter was quite green, but the discharges from the bowels had a natural colour. There was little diarrhœa. The skin was very hot. The abdominal parietes were drawn back, but the abdomen was not painful, except just over the stomach. There was a slight cough, but no expectoration. On the following day she still complained of pain and thirst, and her pulse was 130. At the evening visit the breathing had become much more laborious, and the pupils were dilated. On the 17th the pulse was of the same character, but increased in frequency. The vomiting continued till the evening, when she still complained of the pain, which was worse. On the 18th she was found in the same state, but on the 19th she was seen to be sinking fast. She had twitchings of the left side of the mouth, and was scarcely able to speak, but she said that everything she looked at was green. The pulse had risen to 140. During the night of Nov. 20 she became insensible, and died at 11 a.m. The body was examined after death, and Mr. Paul informed me that the post-mortem appearances were well marked and highly characteristic. The mucous membrane of the stomach was in an inflamed state, but the intestines were healthy. The liver was studded all over, within and without, with small bodies, about the size of a pea, or less, of a greenish-brown colour, and the mesenteric glands were filled with the same sort of bodies. The bronchial mucus was tinged green,

Statement of Mr. Paul, Surgeon of Burton Crescent.

Post-mortem appearances.

Inflammation of stomach and disease of the liver and of the mesenteric glands.

Dr. Harley's description of the state of the stomach.

and so was the conjunctiva. The green colour of the finger nails was very perceptible. Mr. Paul stated that the stomach was preserved in the Museum of University College; but on making application to the Curator, it was not to be found there, nor could I obtain any tidings of it at the hospital; but I was referred to Dr. Harley, into whose hands the stomach had been placed for examination, and from him received the following written statement:—The stomach had entirely lost its colour after being in spirit some weeks, and was not put up; but fortunately Dr. Harley had caused a correct water-colour drawing to be taken of it, which drawing he obligingly allowed me to examine. He described the appearances which the stomach presented when fresh as follows:—1. The mucous membrane presented a delicate pink hue throughout the greater part of its extent. 2. Here and there there were a few irregular dark greenish-coloured patches, like what are observed when the coats of the stomach have been slightly acted on by gastric juice. 3. The pink colour became of a decided red hue towards the pyloric end, and immediately round the pylorus the mucous membrane may be described as being in a state of inflammation. These appearances were specially interesting to Dr. Harley, as they illustrated an important point which he had ascertained in the poisoning of dogs; namely, that while in acute poisoning by arsenic the cardiac end of the stomach is most liable to be effected, in chronic poisoning it is the pyloric end which suffers most.

Conclusions respecting the cases of Matilda Scheurer and Frances Rollo.

Such is the most complete account which I have been able to obtain of the case of Matilda Scheurer. It is one which can leave no reasonable doubt upon the mind of a medical man conversant with the phenomena of arsenical poisoning that the death of this young woman has been rightly attributed to that cause; and this inference will justify itself still more completely if we refer to the details of the effects produced by the emerald green on those young women who have suffered more or less severely from it, but who have recovered from its effects. It is not so easy to arrive at a just conclusion respecting the case of Frances Rollo. It is clear that after prolonged exposure to the poison she appeared to her fellow-workers to be suffering from it in the usual way; also that the symptoms of her last fatal illness, as far as they have been ascertained, are consistent with the supposition of arsenical poisoning; but the appearances discovered in the body after death are such as might have been occasioned by other causes. The diseased conditions of the heart, liver, and kidneys are such as might have originated in a young woman of weak constitution from causes slowly undermining the health and vigour, among which a sedentary occupation carried on in crowded rooms, must be admitted to be the most effective. But, on the other hand, it must be obvious that an arsenical poison gradually absorbed into the system, admitted into the circulation, always present in the minute vessels of all the viscera, and always in the course of elimination through the kidneys, might excite acute inflammation in the heart, which it is known to irritate and excite, as well as chronic degeneration of the kidney. The peculiar disease of the liver is consistent with the supposition of a chronic irritation of that organ due to this cause as well as to others. But in no case is it possible to ignore the injurious part borne by the emerald green in promoting, if it did not wholly produce, the chronic disorder which, passing at length into acute disease, proved fatal to this young woman.

Assuming, then, that we have here two fatal cases, of which the one was clearly due to the action of the emerald green, and the other most probably promoted by it, our attention is naturally directed to the circumstances under which these lamentable results were brought

Fatal results in these cases due to the long persistence in the use of the poison.

about. The first fact which offers itself for consideration is the length of time during which the injurious occupation had been carried on before the last fatal illness set in. Frances Rollo was reported by those who worked with her to have used the emerald green day by day for six months, and Matilda Scheurer, on the same good authority, continued working with it, also day by day, for no less than 18 months, and Mr. Paul in his notes of the case states the period at 20 months. I have also just given an instance of continuous occupation for 12 months. During the whole of this period these young women were for many hours of every day breathing an atmosphere containing the dust of the poison diffused through the space about them by manipulations which brought it into constant contact with their hands, and into occasional contact with other parts of the body. This poison, too, is one possessed of properties so irritating that even strong men working in an atmosphere much less full of its dust generally begin to suffer from it in the course of a few hours, and sometimes even in a few minutes. As it was possible that I had misunderstood my informants, and unintentionally misrepresented them, I thought it right to renew my visits to Mr. Bergeron's establishment, and to make new and careful inquiries, directed to ascertain the facts respecting these cases, as well as to determine by direct inquiries of the young women now employed there how long they themselves had worked without intermission with the emerald green. I was the more anxious to adopt this precaution as, in the course of a conversation with Miss Nicholson, (a lady who prior to the inquest on Matilda Scheurer had visited many workshops in which the emerald green is used, had also seen many young women laid up by it, and had written a popular account of the effects of the poison in the Englishwoman's Journal, July 1, 1861,) I heard doubts expressed respecting the accuracy of statements which implied the possibility of this occupation being continued for weeks and months together.

Visit of verification to Mr. Bergeron's establishment.

That these doubts were, however, without any good foundation my renewed visit to Mr. Bergeron's establishment enabled me to ascertain. I first addressed myself to the intelligent forewoman of whom I have already spoken, and learnt from her that the statements first made to me were not exaggerated. Matilda Scheurer had continued working with emerald green at the "fluffing" process, day by day every day in the week (Sundays of course excepted), for 18 months, but for the last three or four months she occasionally stopped away one day or two days, but never more. This statement was made in the presence of several young women who had worked in the same room with Matilda Scheurer, and who gave their entire assent to it. With regard to Frances Rollo, the original statement was somewhat modified by my informants after consultation among themselves. It appears that she had not worked so long as six months, but only about four months, and during this time not so constantly with the emerald green as many other young women had done. She did not work every day with it, but perhaps on one or two days in a fortnight would work at some other part of the business. Being anxious to ascertain whether other young women employed in this establishment had themselves worked for several successive months at "fluffing" with emerald green, I addressed my inquiries to them in the presence of their fellow workwomen, and obtained the following information:—One young woman (E. H.) had worked in this manner, at the same time with Matilda Scheurer, day by day, more or less, and never left off for one whole day, although she felt ill at times. A second (M. H.) worked in the same way, also with Matilda Scheurer, doing every day more or less

Cases of continuous employment at "fluffing" for many months.

"fluffing" with the emerald green, for from nine to twelve months; but she was never absent one whole day, though she felt more or less ill, with the usual symptoms. A third woman (M. W.), of more mature age, was shown to me as having lost all the hair from the crown of her head by working at fluffing with the emerald green; and she informed me, in the presence also of her fellow-workers, that she had worked during 15 months, also from day to day, but after that time was laid up with the usual symptoms for three months. I may add that on the occasion of this my last visit to Mr. Bergeron's, I found 46 young women working with the emerald green, of whom three were wearing the towels round the mouth and nostrils, or the apron over the face, as a defence from the dust occasioned by the separation of the bundles of stamped leaves, while the rest were without such protection, colouring the leaves by the moist process. They had been so employed for about a month, and yet none of them were suffering from the rash or from the other symptoms. I ought also to state that the representations made to me respecting the continuous employment of Matilda Scheurer and other young women for many months together were acknowledged to be correct by Mr. Bergeron, speaking in the presence of the young women themselves; but that he had an impression, which was evidently not shared by the forewoman or her companions, that during two months out of the eighteen, in the case of Scheurer, some different work was being carried on. It was, however, admitted on all hands that she was working with the poison when seized with her last fatal illness. The work, however, was then carried on not in the present large and airy premises, but in the smaller and crowded rooms in Judd Street, where the space appears by Dr. Hillier's report to have been at the rate of only 150 cubic feet to each worker.

Diligent inquiries have failed to discover other fatal cases.

There is, therefore, no room for doubt that young women do work day by day for months together with this poisonous substance, handling it and breathing its dust side by side with numbers of other women similarly employed; and that, in the very establishment in which this employment has been carried on, one death only has been distinctly traced to it as the sole cause, and one other death as perhaps partly occasioned by it. I may add, that in the course of my extended inquiries among men and boys who make use of emerald green, I have not met with any fatal case. Nor, though I have prosecuted the same inquiries with diligence in the workshops of several artificial florists in which young females from 12 years of age to 20 years of age and upwards are largely employed, have I been able to hear of other fatal cases. The employers and the employed have alike spoken of the fatal case of Matilda Scheurer, and of that of Frances Rollo, whom they sometimes name as her sister, but they agree in stating that they do not know of any other fatal cases. Cases of marked severity and of great suffering are very generally talked of, but no fatal cases. And it affords a very curious confirmation of the result to which my own inquiries have conducted me, that M. Vernois in his "Mémoire sur les Accidents produits par l'emploi des Verts Arsenicaux chez les ouvriers fleuristes en général, et chez les appréteurs d'etoffes pour fleurs artificielles en particulier," * has no direct knowledge of any fatal case, for he says in a foot-note, "On m'a cité un cas de mort." This confirmation of my results is the more valuable as I purposely avoided making any reference to this Mémoire by M. Vernois until I had completed my own independent inquiry.

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* Annales d'Hygiène publique et de Médecine légale, for July 1859.

In the course of my inquiries after fatal cases, I have also asked for the smaller establishments of which Miss Nicholson has spoken, in which very young children are employed in garrets under a mistress, who takes home leaves and flowers to colour with the emerald green; but my informants aver that since the falling off in the demand for the bright green leaves and flowers, these smaller establishments have ceased to exist, the present demand for these articles not being such as to create any difficulty in supplying it out of the larger workshops. At any rate I have not been able to find any of these smaller manufactories, though I have seen several which are carried on on a very small scale, with mean looking shops, and small workshops remarkable for the neglect of cleanliness. In one such shop a Frenchman is trying hard to introduce a colour which is not poisonous, but which still falls far short of the brilliancy of the emerald green.

3. *Summary of Results, with practical Suggestions.*

Summary of results.

I will now bring this account of my inquiries to a close by stating as briefly as possible, and in the form of distinct propositions, the results at which I have arrived; and I will then state the conclusions which I have been led to form respecting the expediency of legislative interference.

1. That emerald green (the aceto-arsenite of copper) is manufactured in large quantities in England, and imported from abroad, to meet the demand occasioned by its extensive employment in the arts.

2. That this extensive use of emerald green in the arts arises out of its valuable and unique properties as a pigment, inasmuch as it yields a colour which for brilliancy is not to be surpassed, and which up to this time has been proved not to be obtainable by any other means.

3. That the emerald green is used as a colouring matter by house painters, by the manufacturers of paper-hangings, by the makers of tinted papers, by letter-press and lithographic printers, by the manufacturers of artificial leaves, seeds, fruits, and flowers, by toy-makers, and (there is reason to believe) by confectioners. It is also sometimes used to colour wafers, and it enters into the composition of cakes of water-colour.

4. That the emerald green is occasionally taken as a poison, and also occasionally administered with a felonious intent; that it has been frequently swallowed ignorantly and by accident (mostly by children) with highly injurious and sometimes fatal consequences; and that it has been so swallowed when used as a pigment for toys, water-colours, green tinted papers, artificial grapes, and articles of confectionery.

5. That when so swallowed, either intentionally or by accident, it proves a very active and fatal poison.

6. That persons who work with emerald green suffer more or less severely from it; but that the greatest suffering is endured, and the greatest risk incurred, by those who are exposed to the poison as a dust diffused through the air.

7. That in consequence of the loose way in which the pigment is attached to some kinds of paper-hangings, but especially to cheap papers made by machinery, persons occupying rooms so papered are liable to suffer, and do sometimes suffer severely, from this cause.

8. That there is some reason to believe that well marked and severe symptoms of poisoning are sometimes occasioned by vapours arising from the contact of moisture with the emerald green, and that this is the explanation of some of the bad effects which have followed the occupation of rooms newly papered with hangings containing the poison.

9. That different persons exhibit very different degrees of susceptibility to the action of the poison, but that few, if any, wholly escape if exposed to the dust for any length of time.

10. That the symptoms occasioned by the poison are mainly due to the arsenious acid which it contains; but that they are probably modified by the copper which also enters into its composition, and which, in a state of minute division, gives rise, as those who work with it allege, to symptoms of the same kind, but of less severity.

11. That the symptoms caused by the poison are partly the result of direct contact with the parts affected, and partly of absorption into the system; that the local symptoms due to contact are the itching and smarting of the nostrils, the sneezing, and discharges of mucus or of blood, and the symptoms of a common cold, also the sore throat, caused by contact with the lining membrane of the nose and mouth, and the various rashes and sores caused by contact with the skin of the exposed parts of the body, and of those covered parts to which the hands are directed; and that the symptoms not directly traceable to contact, but due to absorption, are thirst, nausea, and vomiting, pain in the stomach, diarrhœa or colic, pain in the side, palpitation and shortness of breath, great prostration of strength, drowsiness, headache, dimness of sight, nervous tremblings or twitchings, restlessness, and fever.

12. That though the rashes which occur on different parts of the body are generally the result of the direct contact of the poison, there is reason to believe that there are exceptions to this rule, inasmuch as they do occasionally occur on parts which are protected from contact with the hand, and much too frequently on the pudenda of the two sexes to be ascribed to that cause.

13. That the symptoms occasioned by the poison are both characteristic and disagreeable, and always show themselves in those who work with it long before it threatens to prove dangerous to life.

14. That in spite of the discomfort and sufferings which the poison occasions, young women are found working with it day by day for weeks and months together, some of them with little apparent effect upon their health, others paying the penalty of their indiscretion by long and disabling illnesses; one (Frances Rollo) probably having had her death hastened by it, and one (Matilda Scheurer) dying from it.

15. That it is chiefly among young women employed in the manufacture of artificial leaves, seeds, fruit, and flowers that examples of this perseverance in an unhealthy occupation are to be found, but that men who work with the emerald green, especially those who manufacture the tinted papers, will not consent to continue their employment beyond a few days at a time.

16. That the inconveniences and dangers attending the use of emerald green in the arts are greatly increased by the neglect of cleanliness and of reasonable precautions on the part of the workpeople, and by a similar neglect of cleanliness and want of consideration in crowding an undue number of persons into inadequate spaces on the part of many of the employers.

Summary of the risks entailed on the public by the use of emerald green.

I have now carried this inquiry to the utmost limits prescribed by a regard to the public interests; and I proceed to offer those suggestions for the protection of the public which have occurred to me in the course of it. The dangers to which the use of emerald green in the arts exposes the public are of four kinds. 1. The large use made of the poison, and its free exposure in the places where it is employed offer a temptation to the suicide to select this as the instrument of destruction, and a similar temptation to those who contemplate the destruction of others. 2. The colour of the poison offers a dangerous attraction to young children by whom it is often swallowed, and an inducement to ignorant or reckless persons to introduce it into confectionery and other articles of food, and to make use of it in boxes, bags, or wrappers intended to hold similar articles. 3. The attractive colour of the poison also leads to its being largely used in the manufacture of paper-hangings, and in articles of dress and personal ornament, by which means it may injuriously affect the health of persons unconsciously exposed to it. 4. The use of the poison in the several branches of manufacture just indicated exposes a considerable number of men, women, and children to serious suffering, and even to some risk of life.

Suggestions for the protection of the public.

1. The first source of danger is one against which it is not necessary to provide any special safeguard. The very colour of the poison renders it an unsuitable instrument in the hands of the murderer, and when given to procure abortion it has been disguised in the form of pills.

The sale of the poison to toy-makers and confectioners might be forbidden.

Vendors of the poison to keep a book in which to enter name, address, and occupation of purchaser.

The use of green tinted paper to contain articles of food to be forbidden.

Vessels, &c., in which the poison is kept or sold to be marked "*emerald green, poison.*"

2. The swallowing of the poison ignorantly and by accident might be prevented by measures leading to its disuse in future by toy-makers and confectioners. The sale of emerald green to confectioners or pastrycooks might very properly subject the salesman to a fine, and its employment by the toy-maker might be discouraged by the same means; though the risk of accidental injury from painted toys is perhaps too slight to warrant even this interference with trade. The fact that persons making application for the poison are engaged in these occupations might be ascertained by means of a register-book, which the vendor might be compelled to keep, and in which the applicants should be required to write their names, addresses, and occupations. It would also be not unreasonable to inflict a similar punishment on persons convicted of using paper tinted with emerald green for lining boxes, and making bags or ornamental wrappers, to contain any article of food. And in order to destroy the plea of ignorance, all druggists, oilmen, and colourmen, and all other vendors of the poison might be required to affix to barrels, boxes, cans, bottles, &c., in which the poison is stored or kept, and to all parcels or packets in which it is made up for sale the words "emerald green, poison:" those who make use of the pigment might also be required to keep it in cases or bottles similarly labelled.

Tinted papers to be stamped with the words "*arsenical paper.*"

The same with paper-hangings.

Labels to be attached to articles of clothing, &c.

3. The manufacturer of papers tinted with emerald green might be similarly required to stamp each sheet of such paper with the words "arsenical paper," and the same measure of precaution might be adopted in the case of the manufacturer of paper-hangings: he also might be required to stamp every piece of paper in which the emerald green is employed with the words "arsenical paper." It is also worthy of consideration whether the manufacturers of tarletanes and other articles of dress containing emerald green might not be required to affix a similar stamp, and the manufacturers of leaves, flowers, seeds, and fruits to attach a label with the same words legibly printed upon it to every article sold by them.

Extreme measures of restriction not necessary.

4. If, in addition to the serious discomfort and occasional attacks of illness caused by the emerald green in those who work with it, my inquiries had led to the discovery of several fatal cases, I should have thought it right to suggest the absolute prohibition of such branches of manufacture as had led to these fatal results; but inasmuch as I have only been able to discover one case of death distinctly traceable to the use of emerald green as its sole cause, and that case occurred in the person of a young woman who had persevered in the use of the poison day by day for a year and a half, I am of opinion that no such mea-

Appendix.

III. Industrial diseases.

1. Arsenic industry. By Dr. Guy.

Children might be protected.

sure of extreme precaution is required. I am also of opinion that no case can be made out to justify any special legislation of a highly restrictive character. The effects of emerald green, though disagreeable and even painful, soon subside, and pass away without leaving any permanent disability or constitutional injury behind them. They show themselves, too, at an early period, and in a form not to be mistaken; so that the men and women who work with the poison are able to abandon their employment, to suspend it for a time, or to substitute for it, as occasion may require, some other branch of their trade carried on under the same roof. The case of young children is somewhat different. They are more completely under the control of their parents on the one hand and their employers on the other; and they may be compelled to continue their occupation to the injury of their health and even the risk of their lives. It would not, therefore, be unreasonable to protect these young persons by an enactment which should inflict a penalty on the employer for allowing any person under 18 years of age to work with the emerald green, or in rooms in which the operation known as "fluffing," or any other process which disperses the dust through the air, is being carried on. The effect of such an enactment would be to leave the manipulation of the emerald green exclusively in the hands of men and women of an age to judge and to act for themselves, and who might be fairly held responsible for such injury as might accrue to them from persevering in the use of the poison in spite of the warnings afforded them by their own failing health and strength.

Registration and inspection of workshops.

Difficulties in carrying such registration and inspection into effect.

But if it is not unreasonable to expect from the adult men and women to whom it is thus proposed to restrict the occupation such reasonable care of their own health, it is equally reasonable to demand at the hands of the employers that an occupation obviously and eminently unhealthy, and productive of very distressing consequences, should be carried on in such a manner as to entail the least possible inconvenience, suffering, and danger. This object would be best secured by the compulsory registration and inspection of the premises in which the emerald green is used, whether in the manufacture of tinted papers or in that of artificial leaves and flowers. Such registration and inspection of premises might be extended with great propriety to all factories, manufactories, and workshops in which such operations are being carried on as seriously affect either the health of the community or the health of the persons employed. This suggestion is in accordance with the observations to be found at p. 30 of the "Fourth Report of the Medical Officer of the Privy Council, 1861," in favour of a general enactment which should submit to inspection all premises in which such industrial and manufacturing occupations are carried on. The enactment in question to provide for a minimum cubic space, the ordinary means and appliances of decency and cleanliness, and such special precautions in particular occupations as experience had sanctioned. Such an enactment would confer the greatest advantages on the employed, without entailing any serious inconvenience on the employer. But it unfortunately happens that the occupations which most require supervision are exactly those that may be carried on in small establishments employing a number of hands less than that which would qualify them for inspection; and it is to be feared that a law requiring the registration and inspection of workshops would have the effect of multiplying those small undertakings in which, as experience abundantly proves, all the evils of every trade are carried to the highest point of intensity.

Objections of a general

If to this very probable consequence of a systematic registration and inspection of workshops we add the obvious objection which exists to character to restrictive legislation.

all restrictions on the liberty of manufacture, and to every interference of the Government in the affairs of individuals, and the further risk of the transference of a lucrative trade to countries untrammelled by trade restrictions, we shall arrive at the conclusion that the best course to adopt is to create such an enlightened public opinion as shall, on the one hand, lead to an avoidance of the use of poisonous substances in articles of furniture and dress, and, on the other hand, create an indisposition on the part of the master and the workman to undertake the manufacture of such articles, coupled with a desire to render the processes of manufacture as innocuous as possible, and a salutary dread of the public exposure and censure to which the employer would be liable if death could be fairly traced to his neglect.

Precautions which should be observed by employers.

Now there are certain simple measures of precaution which, if they were equally observed by the employers and the employed, would render the use of emerald green in the arts nearly innocuous. The first and most obvious precaution is to desist from the use of the poison as soon as the characteristic effects show themselves in an intense degree. Such a case as that of Matilda Scheurer ought never to occur again. The second precaution consists in the avoidance of overcrowding; the third in the observance of cleanliness. M. le Dr. Vernois, in the paper already cited, recommends that the workpeople should be provided with a mixture of one part of hydro-chloric acid to nine of water, in which to cleanse the hands by dissolving the poison; the use of the diluted acid to be followed by that of soap and water. He also suggests that the operative, before using the emerald green, should dip the hands in talc-powder. Dr. Prosper de Pietra Santa ("Annales d'Hygiène," vol. x., year 1858, p. 349) gives a remarkable instance of the perfect success attending some simple measures of precaution, among which cleanliness occupied the first place, in the prison of the Madelonnettes, in the persons of the men employed in making the thin tinted paper for the manufacture of lamp shades, balloons, and lanterns. The employer may be reasonably expected to forbid the use of the emerald green day by day for months together; to abstain from crowding too many persons into the same space; and to provide the means and appliances of cleanliness.

Co-operation of the operatives.

The operatives, on their side, may be expected to avail themselves of the means of cleanliness which have been provided for them, and to make use of such other precautions as they may be recommended to adopt. I wish that I could speak with confidence of their readiness to do so.

Uncleanly and reckless habits of the workpeople.

But unfortunately the majority of the working classes of both sexes are very uncleanly in their habits, and very reckless in their proceedings. One of the most painful effects of the emerald green shows itself in the shape of sores on the ends of the fingers and at the roots of the nails; and yet clean hands are rarely to be seen, and the nail-brush seems never to be used; and, though it is well known that slight wounds on the hands are apt to be irritated and inflamed by the poison, and sores once formed by it are known to be kept open by contact with it, it does not seem to occur to the sufferers to protect themselves by using goldbeater's skin or some simple plaster. Again, in such coarse operations as those of preparing paper-hangings, or tinted papers, or sheets of muslin for artificial flowers, not only is the protection of gloves rarely resorted to, but the emerald green is often stirred into the liquids with which it is mixed by the naked human hand. It is true that in those processes which fill the atmosphere with the dust of the poison some precautions are observed, and the towels are very commonly used; but, at the same time, the mode of procedure which is most productive of dust seems to be perversely preferred, even in manufactories which are otherwise the best managed

Avoidance of dust in the "fluffing" process.

In the "fluffing process," for instance, it is usual to dust the emerald green on to the leaves through a little bag of muslin, by which a maximum of dust is produced; whereas the method of pouring the powder from a tea-spoon on to the leaf answers equally well, and has the advantage of creating little or no dust. I will describe this simple process as it was shown to me by Mr. Nicolas, of Chiswell Street. The operative sits on a low stool with an open paper box on his apron, and the vessel of melting wax close to him. He dips the leaf in the wax, and immediately pours the green powder over it from a tea-spoon, flecks the loose powder into the box, and the leaf is finished. Scarcely any dust is produced, and the little that does rise into the air is further removed from the face than in the ordinary process. When the leaves are cut out of sheets of muslin previously stained with the emerald green, the dust may be greatly reduced in quantity by calendering the sheet, and this precaution ought to be always adopted.

If the process just described should prove inconvenient, and it is thought better that the workpeople should be seated at tables, it would surely be easy to devise a plan by which the creation and diffusion of so much dust might be avoided. If the tables were provided with close-fitting drawers, and perforated after the fashion of a wash-hand stand, with circular holes at convenient distances, and each of these holes were fitted with a common tin funnel, the leaves might be made to rest on the funnel, and the emerald green be poured upon them from the spoon. The poison instead of rising into the air as dust, would fall into the drawers as powder, and much that is now wasted might be recovered for use.

Before I bring this paper to a close I ought to observe that both in Germany and in France (in Germany as is sufficiently shown by the letter of Prof. Hofmann, in France as a reference to the several papers cited in this report will show) attempts have been made to restrict the use of emerald green, and to regulate the manufactures in which it is employed. But even these precedents must be applied in England, if applied at all, with caution and circumspection; and the manufacturers who employ the emerald green would have a just cause of complaint if they were subjected to restrictions from which those who make use of other poisonous substances, such as the salts of lead and copper, were free. If there must be restrictive measures, they should be made to apply alike to all manufactories in which poisonous matters are employed; and these restrictive measures could not be safely framed until an inquiry similar to the present, and embracing all these occupations, had been entered into. Perhaps, therefore, the wisest and safest course to adopt at present would be to await the issue of this more comprehensive inquiry, and meanwhile to rest satisfied with recommending with all the authority which ought to attach to a Report of the Medical Officer of the Privy Council, the simple precautionary measures already indicated, namely:—1. The vendors of emerald green to refuse to supply it to any persons known to be confectioners. 2. The persons who keep emerald green in store for sale or use to mark or print upon the barrels, boxes, cases, or glasses containing it, and on the bags, &c., in which it is sold the words, "*Emerald Green.—Poison.*" 3. Manufacturers of tinted papers or paper-hangings containing emerald green to stamp such papers with the words "*Arsenical Paper.*" If suggestions to this effect, emanating from the Privy Council, and coupled with further suggestions for carrying on the most injurious processes of manufacture in the least objectionable manner, should prove to have been generally disregarded, an irresistible argument in favour of legislation will have been afforded by the very persons who are most interested in averting from themselves the expense and inconvenience which all legal interferences must entail. By this policy of expectation, time will also be given for the introduction of improved manufacturing processes, such as that of M. Bérard Teuzelin of Paris, who mixes emerald green, and other colouring matters with castor oil and collodion, and creates sheets of tinted paper and linen without exposing the workmen to inconvenience or danger. For the particulars of this process I refer to p. 337 of the 12th volume of the "Annales d'Hygiène," year 1859.

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2. Phosphorus industry. By Dr. Bristowe.

2.—Dr. Bristowe's Report on the Manufactures in which Phosphorus is produced or employed, and on the Health of the Persons engaged in them.

The persons who have to do with phosphorus are :—1st, the producers of phosphorus ; 2nd, the manufacturers of congreve-matches, and other kinds of instantaneous lights ; 3rd, the makers of certain forms of vermin-paste, of which phosphorus is the active ingredient ; 4th, pharmaceutical chemists ; and, last, medical men, scientific chemists, and others, who employ it rarely, and in small quantities, in the treatment of disease or for experimental purposes.

A.—THE OCCUPATIONS WHICH HAVE TO DO WITH PHOSPHORUS.

1. PRODUCERS OF PHOSPHORUS.

Preparation of phosphorus.

There are only two firms in England, by whom phosphorus is systematically prepared, viz., the firm of Albright and Wilson, of Oldbury, near Birmingham, and that of Eden Jones and Company, (now Procter,) at Bristol. I made personal inquiries of both, and was permitted to see the whole process of extracting phosphorus as it is now conducted at the extensive works belonging to the first-named firm.

(*a.*) Description of Phosphorus.—Two kinds of phosphorus are produced, viz., *common phosphorus* and *red* or *amorphous phosphorus*. The former is a soft, semi-transparent, colourless solid, which, at all temperatures above 32°, fumes in the air, emitting white alliaceous vapours, and in the dark a pale greenish light. It has a specific gravity of 1·83 at 50^{c} ; it fuses at 111·5°, and is extremely inflammable, taking fire in the open air at a temperature very little above its fusing point. It burns with a brilliant white flame, and evolves dense white fumes of phosphoric acid. It produces deep and severe burns, and is a powerful irritant poison. *Amorphous phosphorus* is met with usually under the form of a red powder, with a specific gravity of 2·14. It may be heated in the open air without danger, and without becoming luminous in the dark, till the temperature reaches 500°. At this point it melts, and bursts into flame, emitting dense fumes of phosphoric acid. It absorbs oxygen slowly, however, especially if damp ; phosphorous acid is gradually formed ; and this, from its deliquescent property, renders the powder moist. It may be handled safely, and does not possess poisonous properties. Further, it is insoluble in several of those fluids which act as solvents of common phosphorus.

(*b.*) Preparation of Phosphorus.—Phosphorus is prepared according to the process described in works on chemistry. It is derived almost exclusively from bones, the inorganic basis of which is phosphate of lime. These are calcined (and thus deprived of their animal matter) powdered, and then mixed with a weak solution of sulphuric acid. The sulphuric acid decomposes two-thirds of the bone-earth, displacing its phosphoric acid, and combining with its lime to form an insoluble sulphate. The remaining third of the bone-earth enters simultaneously into combination with the whole of the displaced phosphoric acid, and forms with it a compound readily soluble in water, which is frequently described as superphosphate of lime (2HO, CaO, PO5). On allowing the mixture to stand, the gypsum forms a sediment, but the acid phosphate remains in solution. The supernatant fluid is then poured off, evaporated to the consistence of a syrup, mixed with vegetable charcoal, and heated to dryness.* During this latter process steam is evolved, which is slightly acidulous from containing traces of volatilized phosphoric acid. But up to this point no fumes of a really deleterious nature can by possibility have been produced.

The desiccated compound, consisting of phosphoric acid (with some lime in combination) and charcoal, is then introduced into earthenware retorts, in which it is subjected to intense heat. Decomposition there takes place ; the phosphoric acid, by aid of the charcoal with which it is intermixed, loses its oxygen, phosphorus is liberated, and carbonic oxide, carburetted hydrogen, and phosphuretted hydrogen are evolved. The gaseous products are carried from the retorts, through a system of intercommunicating pipes, which terminate in a perpendicular pipe, usually elevated above the heads of the workmen. They are all combustible ; and are burnt, and thus destroyed or rendered innocuous, at the orifice whence they are discharged. The phosphorus descends from the first pipe connected with the mouth of each retort, is received into an iron or lead pot filled with water, and condenses there into hollow metallic-looking cakes. These cakes of phosphorus are then melted together under water, and brought into large masses, much resembling a Cheshire cheese.

The phosphorus in this form is still somewhat impure, from admixture with low oxides, and traces of amorphous phosphorus. From these, the presence of which scarcely affects its real value, it is then by simple means purified, and bleached.

In order to give the pure phosphorus its ordinary cylindrical form, it is melted under water, and by the heat of steam, in a leaden vessel ; from the lower part of which, horizontal tubes of the required size pass into a trough filled with cold water. The melted phosphorus is forced by its own weight into these tubes, solidifies in them, takes their shape, and finally escapes from their distal extremities, partly impelled by the *vis a tergo*, and partly drawn out by the hands of those who conduct the process. The sticks of phosphorus are then cut into pieces of the proper length, which are immediately placed in water, and packed therewith for sale in tin cans.

I may add, that many years ago the stick-shape was given to phosphorus, by sucking it, while in the melted condition, into glass tubes. This was originally the practice at the works now belonging to Messrs. Albright and Wilson, as well as at others ; but, as the production of phosphorus increased, was necessarily abandoned, in favour of a more efficient mode.

Amorphous phosphorus is made in England by the firm just named only, who hold, in fact, the patent for its preparation. The mode of procedure is simple. A "cheese" of the ordinary phosphorus is enclosed in a cylindrical iron vessel, and exposed continuously, for a month or six weeks, to a temperature of from 400 to 500 degrees. At the end of

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* Up to this point, the description of the process has been extracted in substance from Dr. Miller's Chemistry. The details that follow are derived from personal observation.

that time it has become changed entirely, or almost entirely, into the amorphous variety. In order, however, to prepare it for a subsequent purifying process, and to bring it to a convenient form for use, it is ground under water, and then dried at a moderate temperature on leaden slabs. During the latter process, a little phosphorous acid may be evolved, but only if the purification has been imperfectly effected.

(*c.*) EXPOSURE TO FUMES.—It is obvious, from the above account, that in the process of extracting phosphorus, from first to last, few, if any, fumes of phosphorus, and few of those of its oxides, escape. A trace only of phosphoric acid is mixed with the steam, that arises during the first drying-process, to which the mixture of the impure phosphoric acid and charcoal is subjected. Phosphuretted hydrogen, and possibly at times, by accident, a little phosphorus itself, are evolved during the period of exposure to the intense heat, to which, in a further stage of the operations, the same compound is submitted. But these fumes are burnt as they escape into the atmosphere ; and are hence so far rendered innocuous that though large numbers of retorts are at work simultaneously in one building, I recognized in it no distinctive smell of phosphorus. The further stages are all conducted under water, and there is really, at no one of them, any appreciable effluvium emitted. Lastly, in the drying of the amorphous phosphorus, phosphorous acid is apt to be disengaged, but in *very small* quantities ; so small, indeed, that even if the production of amorphous phosphorus were to become very largely extended, the fumes would doubtless still be of no practical inconvenience.

(*d.*) PERSONS EMPLOYED.—There are not more than 60 or 70 persons altogether employed in the preparation of phosphorus ; and a large number of these are engaged in operations, which in no degree expose them to the chance of inhaling its fumes ; so that, in point of fact, a very small number of workpeople are liable to inhale even those trifling effluvia, which attend the most noxious (if it be fair to use that term) stages of the process.

2. MATCH-MAKERS.

Manufacture of matches.

The manufacture of matches absorbs almost all the phosphorus which is produced. This statement, which is unquestionably a true one, I am unable to confirm by trustworthy English statistics : but, in reference to France, its accuracy is shown by M. Chevallier, who says, " it is estimated that, for this purpose (match-making), about 36,000 " kilogrammes of phosphorus are consumed annually, while for all " other purposes together scarcely 100 kilogrammes are employed."*

There are in England at the present time about 57 match-making establishments, employing between them upwards of 2,500 hands. They are distributed as follows :—

In London	33	Nottingham	3
Norwich	4	Liverpool	2
Bristol	4	Birmingham	2
Manchester	3	Leeds	2
Newcastle	3	Leicester	1

The above, all of which I have visited, comprise all the larger manufactories, and all, or nearly all, the smaller ones. But it is not

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* Dictionnaire des Altérations et Falsifications des Substances Alimentaires, Medicamenteuses et Commerciales, par M. A. Chevallier. 3rd Edition, vol. 2, p. 226, note.

impossible that a few of these latter may have escaped observation, for they are set up from time to time by persons of little or no capital (especially by such as have been dippers in the employment of some of the larger firms), and disappear almost before their existence has been discovered. Indeed one, if not two, of the factories above enumerated have I believe, since I saw them, ceased to exist. How greatly the manufactories vary in size will appear from the fact, that the largest London maker employs constantly nearly 500 hands, uses about 160 lbs. of phosphorus per week, and makes on the average per diem (in addition to a large number of vesuvians) 10,000,000 congreve-matches, and 3,000,000 wax-vestas; while the smallest makers employ, in many cases, none but members of their own families, produce only between 70 and 100 gross of boxes (containing about 80 matches to a box) per week, and use not more than 3 lbs. or 4 lbs. of phosphorus in the same period of time.

(*a*.) VARIETIES OF MATCHES.—"Instantaneous lights," as they are sometimes called, may be divided into two classes:—1st, those, such as *congreves* and *wax-vestas*, which are used specially for domestic purposes; and, 2nd, those,—*vesuvians* and *fuzees*,—which are manufactured expressly for the use of tobacco-smokers.

Congreve-matches are the ordinary wooden matches of the shops. They consist of wooden "splints" of from two to three inches long, one end of which is coated with sulphur, or saturated with stearine, paraffine, or some such combustible substance, and tipped with a composition containing phosphorus. This composition, in some cases, forms a smooth button, in others seems smeared on unevenly and scantily. These differences depend on important differences in the process of manufacture, and the matches presenting them are known in the trade as *frame-dips* and *bundle-dips* respectively. Some congreves are spoken of as *damp-proof* matches and others as *silent-lights*;—the former being always frame-dipped, while the latter are generally bundle-dipped matches. In the damp-proof matches, which are the better kind, there is comparatively little phosphorus employed, and much chlorate of potash, and they ignite, consequently, somewhat explosively; in the silent-lights, to which all bundle-dips belong, the proportions of these ingredients are reversed, and their ignition is noiseless, or nearly so.

Wax-vestas are matches in which the wooden splint is replaced by a slender cylindrical wax-taper, from 1½ to 2 inches long. This feature, together with the fact that they are invariably frame-dips, constitutes the essential difference between them and congreves.

Vesuvians consist of wooden splints, generally about 1½ inches long, of which, sometimes one end, sometimes both ends, are armed by the peculiar composition which characterizes them. There are two distinct, and well-known, varieties of this kind of match:—the *vesuvian*, properly so called, and the *blazer* or *flaming* vesuvian. In the *former*, the inflammable material is a black globule about the size of a large pea, the pole of which has been dipped in a composition containing phosphorus. The phosphorus-paste is ignited by friction, in the usual way, and then sets light to the subjacent globule, which burns like touch-paper, comparatively slowly and without flame. In the *flaming vesuvian*, half an inch or more of one end of the match is surrounded by a thick cylinder of a reddish brown composition, the tip of which, as as in the former case, is armed by the phosphorus-containing mixture. This match also burns gradually from apex to base; but, in the act of burning, throws out perpendicularly to the surface a circle of flame, from half an inch to an inch in radius. There are several sub-varieties of both kinds of vesuvian, for one or two of which patents are held; but their peculiarities, so far as I know them, consist in details important only to the manufacturers, and needing, therefore, no description here.

Fuzees consist of thick pieces of touch-paper, about as long as the box which holds them, and an inch in breadth, cut comb-like into teeth about a fifth of an inch wide, the free extremities of which are smeared with composition containing phosphorus.

Bryant and May's patent safety matches.—The firm just-named exhibited, at the late International Exhibition, a kind of match to which they had given the above name, and for which they received a prize medal. Their match is intended to obviate the danger, which arises from the ready, and spontaneous, inflammability of the ordinary kind of match; and also, from peculiarities in its manufacture, to save the workpeople from the diseases, which are incidental to match-making as at present conducted. The matches are peculiar in the fact that the composition, in which they are dipped, contains chlorate of potash, but no phosphorus; they are, therefore, not spontaneously inflammable. But the boxes, in which they are sold, are coated with a layer of composition containing amorphous phosphorus, which is also not spontaneously inflammable, but has the property of producing ignition, under the influence of friction, in such a compound as that, with which the matches are tipped.

(*b.*) MANUFACTURE OF MATCHES.—As may be gathered from the above brief description of the different kinds of matches which are in use, there is necessarily a general resemblance in their mode of manufacture. There are necessarily also differences. In the account, which I am about to give, of the process of manufacture, I shall, therefore, first go pretty fully into the subject of congreve-making; but shall, in reference to the other kinds of matches, content myself with dwelling on those points of their manufacture which are peculiar to them individually.

i. CONGREVES.—The manufacture of these matches constitutes by far the most extensive branch of match-making. All the metropolitan firms but five or six are engaged in it; and all the country firms, except the two at Birmingham, devote themselves to it exclusively.

Box-making. — Frequently in the country, and occasionally in London, the making of match-boxes is conducted on the premises, by special hands. Very often, however, the boxes are "put out" to make to workpeople who carry on their avocations at home, but connect themselves with a particular match-making firm, for whom alone they work. There are also in London a few box-makers, on a larger scale.

Splint-cutting.—Almost all the London congreve-makers buy their splints ready cut. A few of the larger metropolitan manufacturers, however, and almost all those in provincial towns, cut them for themselves by aid of machinery. The splints, which are twice the length of the matches they are intended to make, are tied, like firewood, into cylindrical bundles, measuring about half a foot in diameter.

Charring the Splints.—The first process, through which the splints pass in their progress of conversion into matches, is that of having their extremities, to which the light-producing materials are intended to adhere, slightly charred. This is simply effected by placing the bundles on end upon a heated metallic surface (either that of a stove, or one specially arranged for the purpose), and allowing them to remain there until the extremities have become slightly brown, and the portions of shaft immediately adjoining are dried. The chief object of this preliminary process seems to be to ensure the complete adhesion of the sulphur to the ends of the matches, or the complete saturation of these parts with the oleaginous material, whatever it may be, which is used in the place of sulphur.

Sulphuring, &c.—The splints are now dipped either in sulphur, paraffine, stearine, or some such substance, with the object of rendering them more inflammable than they otherwise would be, and more apt to catch fire from the ignited phosphorus-composition. Sulphur is the sole material employed for this purpose in the manufacture of *bundle-dips;* it is used, too, far more extensively than either of the others, in the making of *frame-dips.* It answers admirably the purpose for which it is intended, but it has the obvious disadvantage of causing, during the burning of the match, sulphurous acid fumes. Hence, most of the larger makers, especially those in London, have adopted in the manufacture of their best matches some other inflammable material, which is free from this or similar objection. For the purpose of sulphuring the matches, the sulphur is melted in an open vessel over a fire or stove; and then both ends of the bundles of splints are successively dipped into it. The extremities of the splints thus become completely invested with sulphur; but, at the same time, an excess of this material is retained in the interstices between them, and they become as it were glued together. In order to remove this excess, and, at the same time, to disunite the splints, the bundles are pressed and rolled forcibly by hand, upon the floor or upon a board. Those who perform this duty are called sometimes "pickers." When stearine or paraffine is used, it is melted in a steam-bath, and the splints are simply dipped into it, no further manipulation being necessary.

Frame-filling.—The next process, in the case of the cheapest kind of matches, is that of "dipping," or of coating the heads of the matches with the composition, containing phosphorus. In the case of the better class of matches, however, the important process of *frame-* or *clamp-filling* now takes place. Frame-filling consists in arranging the splints, already cut to the intended length of the match, in square wooden frames, at equal and short distances from one another; and in so fixing them, that their extremities form a level surface on each side of the frame. The frames are generally about two feet square, and fitted with parallel crossbars of wood, which present on their upper surfaces, at short intervals, numerous parallel grooves, passing from before backwards. These bars are readily removable, and are capable of sliding freely up and down in the frame, between its perpendicular sides. In the process of frame-filling, the splints are first laid uniformly in the grooves of the lowest crossbar, and are then fixed in their position, by allowing the next crossbar to rest immediately upon them. The same process is repeated with each crossbar, until the frame is full, when the whole is secured. The *clamp* differs little from the *frame*, and needs no special description; it is, in fact, simply an inferior kind of frame, (in use amongst the smaller match-makers,) in which the splints are arranged uncut, and therefore of double length.

Mixing.—Preparatory to the dipping of the matches, the composition, in which they are to be dipped, has to be made. This composition varies, as regards its ingredients and their proportions, not only according as it is made by different manufacturers, but according to the kind of matches for which it is intended. The essential component parts are phosphorus, chlorate of potash, and glue. The phosphorus is employed, of course, for its ready inflammability under the influence either, of gentle heat, or of friction; the chlorate of potash, for the facility with which, when exposed to the minutest spark, it explodes and bursts into flame; and the glue, for the sake of combining, and consolidating, the two former substances. Besides these, powdered glass generally forms a considerable item in the mixture, and small quantities of colouring matter, such as red-lead, sulphuret of antimony, Prussian blue, and vermilion, are, according to taste, incorporated with it; occasionally peroxide of manganese is added. I may here mention that, in the manufacture of many of the foreign matches, gum was, and I believe is, often used in the place of glue, but that it has been discarded in England on account of its tendency to attract moisture; and further, that in many of the matches from abroad, as also was the case years ago in some of the English matches, chlorate of potash is omitted, and phosphorus therefore used in very large excess. Indeed, it was to obviate the excessive use of phosphorus that chlorate of potash was introduced.

The strength of the composition in phosphorus varies considerably among different makers; but the composition, which is used for frame-dips, is invariably much weaker in this respect, than that employed for bundle-dips.

For frame-dipping, several of the best manufacturers employ a composition containing only about 1 part of phosphorus in 20; some a composition containing 1 in 16; some a composition containing 1 in 12; and one very large manufacturer uses a composition, of which phosphorus forms no less than one-sixth part. The quantity of chlorate of potash employed is generally in inverse proportion to the quantity of phosphorus; and those, who use least of the latter, put sometimes as much as 9 parts in 20 of chlorate into their composition.

For bundle-dipping, powdered glass is omitted, chlorate of potash is absent, or in very small proportion, and phosphorus is greatly augmented—forming from one-fifth to one-third by weight of the entire composition.

In preparing the composition, the ingredients which require pulverizing have to be ground or mullared. The glue is melted in a steam bath, and then the phosphorus is introduced into it, and stirred in it, until the two are perfectly combined; next, the powdered glass and colouring matter are thrown in, and incorporated in a similar manner; and finally, the chlorate of potash, previously moistened, is added to the semifluid mass, and the whole is stirred until the admixture is complete. It is hardly necessary to say that, certain precautions have to be taken, to obviate the danger of explosion, arising from the mixture of the phosphorus and the chlorate. More than one serious accident has been caused, by first diffusing the chlorate through the glue, and then adding the phosphorus to it; and more than one, by allowing the complete composition to dry, and by manipulating it when in that condition. I need scarcely say too, that the use of *dry* chlorate necessitates violent explosion. But I believe, if the ordinary practice which I have described is carried out, there is no danger whatever of accident.

Dipping.—The mode of dipping is different in the case of bundle-dips, from that which obtains in the case of frame-dips. Bundle-dips are tipped with phosphorus, much in the same way that they are coated with sulphur; that is to say, the entire bundle of splints is dipped, first at one end and then at the other, into the phosphorus-composition. In order to effect this, a small portion of the heated, and still fluid, paste is poured on to a flat stone or metal slab, which itself is kept warm by the heat of steam, or in some other way. The paste is then spread into a very thin layer by means of a spatula. Into this the bundle is dipped end-ways, and thus the extremity of each splint acquires a very slight and thin coating. Both ends of the bundle are treated in the same manner, and then the bundle is set aside to dry. Subsequently, a second coating of phosphorus is added. Some makers, instead of spreading the composition on a stone, dip the bundle lightly into the composition as it lies in bulk in the vessel in which it has been melted.

Much more care is taken with the dipping of frame-matches. For these, the composition is spread by means of a spatula, on a smooth stone or metallic surface (warmed by steam, or otherwise) in a uniform layer, of some thickness. The prepared frame is then taken in the hands of the dipper, and by him placed horizontally upon the dipping-stone, so that all the ends of the splints, on one side of the frame, are made to sink to the bottom of the layer of composition. On removing the frame, each splint is found tipped with a small button of paste, which, in the process of drying, acquires by its own weight the ordinary ovoid shape.

To the above account I may add, that the bundles of splints, after being dipped in the phosphorus-paste, require "picking," as they do after sulphuring; and that, as clamp-dips have generally twice the length of frame-dips, they, like bundle-dips, have to be coated at both ends.

Drying.—After dipping has been accomplished, the matches have to be dried. This is generally effected, at all events in the better manufactories, by placing the matches in drying-rooms—rooms specially adapted for the purpose, artificially heated, and fireproof. The frames are arranged in them horizontally in racks. During warm, or summer, weather the drying is often carried on in the open air. In some cases, and this is especially true of the smaller factories, the matches are placed to dry in the general workshop.

Boxing.—The last stage is that of boxing. After the drying is complete, the splints are removed from the frames, or loosened from the bundles (as the case may be) by persons who go often by the name of *emptiers.* The same persons act as *boxers* or *lidders*, which names sufficiently express the nature of the duties they have to perform. During these processes the matches frequently take fire, and have to be extinguished by pressing them into damp cloths.

Cross-cutting, or bisecting the original splints, is effected at different stages of the manufacture. In making frame-dips, it is done prior to the stage of frame-filling; but, in the case of clamp-dips and bundle-dips, it is performed subsequently to the dipping, and immediately previous to boxing. In the latter case, this duty now and then falls to the lot of a particular class of operatives, but more generally it is performed, with the aid of a special cutting-apparatus, by the boxers themselves. Cross-cutting, like boxing, is often attended by ignition of the matches; and I am informed that this danger is much greater with the better class of matches, which contain an excess of chlorate, than with the inferior class; and that hence it is that, in frame-dipping, splints are employed, which have previously been cut to the proper length.

ii. WAX-VESTAS.—These, constituting the best kind of matches, are made by a comparatively small number of persons only. With the exception of the two Birmingham manufacturers, who make nothing else, none of the country makers is engaged in their production. Eight only of the London firms make them. The only points in which their manufacture differs from that of the frame-dipped congreves, are;—first of all, that wax-tapers have to be made in place of splints; and, second, the absence (which their composition obviously necessitates) of the stages of charring and of sulphuring, or of that process which (according to circumstances) takes the place of sulphuring.

In *making the tapers* (which is almost always done, away from those parts of the premises in which the other operations are conducted) the bundles of threads, which are to constitute the axis of the tapers, are wound round two large cylindrical wooden wheels. These are placed at opposite ends of a long room, and the loop of threads between them is allowed to dip into a shallow copper vessel full of melted wax placed mid-way between them. By revolving the wheels, the entire length of the threads is made to pass through the pan, and thus to receive a coating of wax. This procedure has to be thrice repeated before the tapers have assumed their proper condition. They are then removed, and cut into short lengths; and these latter then undergo the various processes, (which have been already described,) of frame-filling, dipping, drying, and boxing. To show the extent of the manufacture of these matches, I may mention that one of the largest London makers informed me, that he uses daily, in the making of tapers for wax-vestas, no less than 216 lbs. of cotton.

iii. VESUVIANS.—This kind of match is made by 14 or 15 London firms, but by none of those in the provinces. The processes of frame-filling, drying, boxing, and (essentially) of dipping, are the same for vesuvians as for congreves. No sulphur, stearine, or such like substance, however, is applied preliminarily to the splints. There are two stages in the dipping; in the first, the head of the match is coated with a composition which is inflammable, but not spontaneously so, and to the slow burning of which the special value of the article is due; in the second, a little phosphorus-containing composition is added, on which the ignition of the match depends.

In the common vesuvian, the first-mentioned composition is black, and consists essentially, I believe, of charcoal, nitre, chlorate of potash, and gum; to which is sometimes added, for the sake of their agreeable odour, either cascarilla, benzoin, or storax, or a combination of them. There is nothing special to be said in regard to the employment of this composition, beyond the fact, that in order to ensure a sufficiency of it to each match, the dipping has to be repeated two or three times. The second composition, with which, after they have been thoroughly dried, the vesuvians are tipped, consists of a paste, differing little from that employed for congreves, excepting in the circumstance that it contains a comparatively large amount of phosphorus (about one-sixth), and that gum is used generally in place of glue. Gum is found practically, I believe, to be better suited, than glue is, to the ingredients employed in the making of vesuvians.

In the flaming or blazing vesuvian, the second composition is identical with that which has just been described; but the first has mixed with it a certain proportion of amorphous phosphorus, which gives to it, or at least enhances, the peculiar property, to which the match owes its name.

iv. FUZEES.—There are very few makers of fuzees in England, and these are confined to London; indeed, I am informed that fuzees scarcely meet, at the present time, with any sale in this country. In manufacturing fuzees, 1st, large square sheets of thick brown-paper are saturated with nitre; 2nd, in order to give the proper thickness to the fuzees, two such sheets are pasted together, and then are dried; 3rd, the prepared sheets are cut into slips of the requisite width, and these again are divided into proper lengths, and toothed; 4th, the fuzees are then placed on a board, so that the free edges of the teeth may project slightly beyond it, and these are then smeared on one side with phosphorus-paste by means of a stick, which is dipped from time to time in a vessel containing the composition; 5th, the teeth, which have been glued together by the mode in which the composition is applied, are then separated by hand; 6th, the name is stamped upon them; 7th, they are put aside to dry; and, lastly, they are boxed.

The composition which is employed for fuzees is, I believe, strong in phosphorus. It contains nitre, but no chlorate, and is not very explosive. Very little of it is needed.

v. BRYANT AND MAY'S PATENT SAFETY MATCHES.—Both congreves and wax-vestas, and, indeed, vesuvians also, are made on this principle. The only differences, as regards the manufacture, reside in the nature, and in the mode of mixing, of the light-producing ingredients, and in the manner of their employment.

The composition, in which these matches are dipped, consists of chlorate of potash (which is the chief ingredient), red lead, black oxide of manganese, sulphuret of antimony, and glue. This is spread on a warmed stone slab, and the matches are armed with it in the usual way. The composition, which is attached to the exterior of the boxes, is composed of amorphous phosphorus, sulphuret of antimony, and glue. Commixture of the ingredients is effected by stirring, under the heating influence of steam; and the spreading of the paste on the boxes is performed simply by means of a brush. It is right to add that Mr. Hynam, of Finsbury, tells me that he made similar matches 12 years ago, and has continued to manufacture them ever since.

(*c.*) PERSONS EMPLOYED.—*Box-making* is a special business, and the hands employed upon it are in no way exposed to the fumes of phosphorus, except in a few of the smaller factories, and especially in those in which match-making is conducted in the dwelling-house, and in which all the operations connected with it are carried on by different members of one family. *Splint-cutting* is done by machinery, and requires, even in the largest congreve-factories in which it is carried on, not more than three or four workpeople. The duty of these is to regulate the machinery, to collect the splints as they are cut, and to tie them into bundles. This process again is conducted in a separate department. The *making of tapers for wax-vestas* also employs very few hands (mostly women or girls), who, from the nature of their operations, are not necessarily exposed to any deleterious fumes.

Of those who work at the various processes of actual match-making, the *frame-fillers* and the *emptiers* or *boxers* are, numerically speaking, by far the most important. The *frame-fillers* are mostly children (boys and girls) from about 8 to 15 years of age; but amongst them may be occasionally seen older persons, and some even who have attained adult age. They vary, of course, in the length of time they have been engaged in the business; but it is not uncommon to meet with persons who have continued in it for six, seven, eight, or even ten years. The *frame-fillers* form generally from half, to two-thirds of, the entire staff of all match-makers, except those who manufacture bundle-dips exclusively, or in large proportion. The *boxers* are, for the most part, more advanced in years than the frame-fillers, and, indeed, in a large number of cases, are derived from them. They vary generally in age from about 15 to 30. They are mostly females, and, from the fact just stated, have often been employed in match-making for several years. There are usually, perhaps, from one-third to one-half as many of these as there are of the clamp-fillers. The *mixers* and *dippers* are relatively few, are almost invariably men, and have generally been employed for some time previously in the subordinate branches of the business. In the smaller establishments, there is a single dipper (who is often the proprietor), and who generally acts at the same time as mixer and general manager. Several of the larger establishments employ three or four dippers; and one only, as many as six. But in addition to these, there may be one or two who occasionally assist. Mixing, when this is made a separate duty, engages not more than from one to two persons. Besides these, there are generally a few others (for the most part boys or quite young men) whose duty it is, to clean the slabs on which the composition is spread, to stir the composition, to carry the racks on which the frames are placed to and from the drying-rooms, to do the sulphuring, the picking, and certain other minor operations, including sometimes cross-cutting. I may add that, although in the larger manufactories all the above branches of match-making are kept more or less distinct; it is common in the smaller ones for the same hand to be occupied at different times in all the various operations. Thus, the boxers fill up their spare time with frame-filling, and the mixers and dippers, when their special duties are completed, employ themselves in box-filling, sulphuring, and so on.

The work-day, inclusive of dinner-time, is generally 12 hours; but the dipping and mixing rarely, if ever, occupy the whole of this time. In the smaller establishments, an hour or two a day only are thus employed, often less; and, even in the most extensive works, from six to eight hours are rarely exceeded. Ten hours form the maximum. In Bell and Black's establishment, each dipper is forbidden to work at dipping for more than one day and a half per week, and the mixing occupies one day only out of the seven. But, so far as I know, in all the other large factories, the dippers and mixers work continuously day after day at their respective duties.

(*d.*) WORKSHOPS.—The places in which match-making is carried on vary extremely, in almost every respect. In the larger and better-ordered establishments, there are generally separate rooms for each of the processes of sulphuring, mixing, and dipping; there are special fire-proof drying-rooms; and also large rooms, in which frame-filling and boxing are conducted. There are great differences, nevertheless, even among the larger manufactories. Thus, to take Letchford's factory as an example. There are first three very large, well-ventilated rooms in which the frame-fillers and boxers, under the eye of foremen, work exclusively. There is then a large, lofty, extremely well-ventilated apartment, in which the six dippers, with their assistants, work; and leading from this by doors are six artificially-heated fire-proof drying-rooms (one to each dipper), in which the matches, after they have been dipped, are placed to dry. There is then another room, perfectly distinct from the above, in which the mixing and paraffine-dipping are conducted. Neither of the latter rooms has any fire in it; but hot water is conveyed to them from a boiler by means of pipes, and it is by the heat of this alone that the various operations, requiring the aid of heat, are conducted. Adjoining the mixing-room, however, there is a small apartment, in which is a stove, by means of which the splints are charred, and the sulphur for sulphuring is melted. Throughout this establishment, the ventilation is excellent, and is effected solely by doors, windows, and such-like simple means, aided by the loftiness and size of the various apartments. In Martindale's factory, in Liverpool, there is a separate apartment devoted to sulphuring, and there are special drying-rooms; but, with these exceptions, all operations are carried on in one room, 164 feet long by 32 feet wide, and proportionately lofty, and well-ventilated by windows and louvre-boards. In this room the mixing is done, the dipping is performed by two men working at two different stones, and the frame-fillers and boxers carry on their avocations. In Dixon and Evans's manufactory again, there is one large room, ventilated by louvres and a couple of large fans, in which frame-fillers and boxers work, and in which also a dipper is employed. The stone, on which the dipping is performed, is against a wall, in which, immediately above the stone, is a hood connected with a flue which helps to carry off the vapours. A second very extensive room is devoted to frame-filling. In a third room, which is lofty, and ventilated by louvres and fans, two dippers work, and the matches are placed in racks to dry. In a fourth, extremely airy room, the cross-cutters work. And in a fifth, which is very lofty and airy, box-filling alone is carried on.

There are still greater varieties among the lesser manufacturers. In some instances the entire business is conducted in a single small room, and that room may be one of the rooms in the dwelling-house of the proprietor. In other cases all the different operations are carried on in one small ill-ventilated shed. In other cases, again, the premises are ample and airy, but still every branch of the business is conducted in the same apartment. And in yet others, the premises, though on a comparatively small scale, are constructed, and arranged, with as much, or almost as much care, as those of the best of the larger manufacturers.

(*e.*) Exposure to Fumes.—Without even visiting any of the manufactories, it might be assumed;—that vapours of phosphorus would escape at various stages of match-making; that some of the processes especially would yield them largely; and that the different hands, employed in the business, would be variously exposed, partly according to the special branch of it in which they were engaged, and partly according to the arrangements of the particular factory in which they had employment. In the process of mixing the composition, (in which the phosphorus is melted in boiling glue, and stirred in with other ingredients until the whole is thoroughly incorporated,) fumes necessarily escape in considerable abundance. In the process of dipping also, (in which a vessel full of heated and fluid composition is always at hand, and in which some of this is being constantly spread on a warm stone by means of a spatula, and still further stirred up by the act of dipping,) white fumes, consisting chiefly of phosphorous acid, are given off even more abundantly than in the former case; and the fumes are increased, and have phosphoric acid mixed with them, by the occasional ignition of small portions of the composition. During the drying of the matches, again, fumes are emitted continuously, and, though scarcely visibly, on the whole very abundantly; so that the drying-rooms are invariably pervaded by a very powerful smell of phosphorus. In the process of boxing, too, phosphorus-vapours are constantly being evolved, though in a much less degree; so also in the process of cross-cutting, and in that of picking out, or separating the bundle-dip matches, after they have been phosphorized. In each of these latter processes, there is great tendency in the matches to ignite, and so for the fumes of phosphoric acid to become intermixed with those of the lower oxides. The above are sources of the vapours of phosphorus which are common to all congreve-manufactories; but it is important to understand, that the greater the proportion of phosphorus to the other ingredients of the match-composition, the more abundant, in every one of the above processes, are the fumes which escape. Indeed, it would appear that, the abundance of the fumes is even more than proportionate to the per-centage of phosphorus employed; that, for example, where the composition contains but a small quantity of phosphorus, this not only fumes comparatively little during the mixing and dipping, but is fixed by the glue with which it is combined, so that scarcely any smell arises during the drying, and scarcely a trace from the completed matches during the subsequent stages; that, on the other hand, where the composition is overloaded with phosphorus, the phosphorus not only escapes very copiously during the earlier stages of the manufacture, but not being retained by the glue, evolves abundant fumes during all the subsequent stages; so much, indeed, is this the case, that single boxes of these matches continue to smell powerfully of phosphorus long after they have left their maker's workshop. The best frame-dips therefore yield, *cæteris paribus*, during their manufacture, a far less amount of effluvium than the commoner kinds of matches, and especially than bundle-dips. I may add, too, that the matches which are armed with brown composition (containing antimony) always have (from the circumstance that the presence of the antimony promotes inflammability) less phosphorus than those of which the composition is coloured blue (containing Prussian blue and indigo); and that, therefore, the manufacture of the latter, as a rule, is attended with a much greater escape of fumes than that of the former. In the making of vesuvians and fuzees, although the composition employed is rich in phosphorus, the smell is comparatively slight; this seems to depend simply on the fact that very little of the phosphorus-paste is employed in the manufacture of these articles. I need scarcely add that, in the manufacture of matches with amorphous phosphorus, no fumes whatever, containing phosphorus, are at any time evolved.

From the account just given, it is obvious that those, who are engaged in mixing and dipping (the mixers and dippers and their assistants) are, from the very nature of their work, especially exposed to the fumes of phosphorus; that those, who frequent the drying-rooms, are also much exposed; that the boxers, cross-cutters, and the like, cannot wholly escape; and that, *cæteris paribus*, the makers of bundle-dips, and of blue matches, work in a more poisoned atmosphere, than those who produce frame-dips and brown matches. It is obvious, too, that the frame-fillers need not inhale the slightest particle of any such emanations. In some manufactories, however, as before stated, all the operations are conducted in one room, and hence every one is exposed, to a certain extent, to the fumes that arise. In a few even, the matches are placed to dry in the room in which the frame-fillers and boxers work, and thus these latter become quite unnecessarily surrounded by a strong atmosphere of phosphorus-vapour. In most of the better establishments, the boxers and frame-fillers occupy workshops of their own, and hence are exposed to such fumes only as are emitted from the already-dried matches. For the most part these fumes are slight, but they are quite capable, under the influence of overcrowding, bad ventilation, and the manufacture of inferior matches, of becoming very powerful.

3. MAKERS OF VERMIN-PASTES.

Manufacture of vermin-paste.

There are, in England, several persons, or firms, engaged in the manufacture of substances designed to destroy mice, beetles, and other of the smaller kinds of vermin. Of these, some two or three, I believe, make a paste, of which the active ingredient is phosphorus. The process of manufacture seems to be regarded as, in some degree, secret; at all events, I have failed to obtain permission to see it in operation, or indeed to obtain from the actual manufacturers any trustworthy information concerning it. One of them (Mr. Roth), of the firm of Roth and Ringeisen, however, informed me that they had carried on the manufacture for 14 years, that from six to eight persons were engaged in it, and that they used between 30 lbs. and 40 lbs. of phosphorus per week. I understood also from him, that the workmen were little, if at all, exposed to the vapours of phosphorus.

These pastes are, probably, not very dissimilar, in their mode of manufacture and in their composition, from those of Duboys, of Paris, and of Simon, whose formula was published in April 1843, at the request of the Prussian Government. Simon's formula runs thus:— Take of phosphorus 8 parts, liquify it in a mortar with 180 parts of boiling water, and add 180 parts of rye-meal; when cold, mix in 180 parts of butter, and 125 of sugar. Duboys' recipe is as follows:—Take of phosphorus 20 parts; boiling water, flour, and melted fat, of each 440 parts; mix well together, and then add of nut-oil 200 parts, and of powdered sugar 250. This compound is more fluid than the former, and is used by spreading it over thin pieces of bread. In a case of poisoning by Roth and Ringeisen's "phosphor paste," recorded at page 147 of the 2nd vol. of the Medical Times and Gazette for 1857, Mr. Herapath tested this compound, and found it to contain 5 per cent. of phosphorus, mixed with starch, water, and colouring matter.

4. PHARMACEUTICAL CHEMISTS.

Manufacture of phosphoric acid, hypophosphite of lime, and chlorides of phosphorus.

Phosphorus is employed, by some manufacturing chemists, in the production of certain articles, which are required in comparatively small quantities, and solely for medicinal and scientific purposes. The articles referred to are, I believe, the following only:—*Phosphoric acid, hypophosphite of lime, phosphide of calcium,* and the *chlorides of phosphorus.* These articles, however, are made, even by those who produce them most largely, in comparatively small quantities, and at varying, and often distant, intervals of time. The operations, moreover, are generally, if not always, conducted entirely under a hood, communicating with a shaft, which at once carries away any deleterious fumes that may arise; so that the one or two persons employed in superintending the process are really not exposed in any degree to their influence. Through the kindness of Messrs. Hopkin and Williams, of New Cavendish Street, I was permitted, in company with the latter gentleman, to visit their works at Wandsworth, and am enabled to give the following brief description.

Phosphoric acid is made by adding phosphorus slowly, in small pieces, to boiling weak nitric acid; and by continuing the boiling, after sufficient phosphorus has been added, until all the nitric acid has been converted into nitrous acid, and the latter has been entirely expelled. The nitric acid, in proper quantity and of the requisite strength, is first placed in a retort or still of glass, or some analogous material. The still is surmounted by an elephant-head, which leads to a condenser, and in the summit of which is an orifice closed by a stopper. The end of the worm of the condenser is received either into a solution of caustic potash or into milk of lime. The nitric acid is then made to boil, and the phosphorus is added, from time to time, in small pieces, through the orifice in the summit of the elephant-head, until a suitable quantity has been used. The addition of the phosphorus to the boiling nitric acid causes decomposition; phosphoric acid is formed at the expense of some of the oxygen of the nitric acid, and the latter becomes reduced to nitrous acid. The phosphoric acid remains in the still, but the greater part of the nitrous acid passes through the condenser, and becomes fixed by the caustic potash or lime. A little of the nitrous acid, however, escapes from time to time (when the stopper is removed) from the orifice in the elephant-head; and a little, at the end of the process, remains dissolved in the solution of phosphoric acid. The solution is then removed from the still, and placed in an open platinum vessel, in which it is boiled, until the whole of the nitrous acid is expelled, and the solution becomes colourless. The solution then contains phosphoric acid alone, and needs only to be reduced to the pharmacopæial strength, by the addition of a sufficient quantity of distilled water.

Hypophosphite of lime is manufactured simply as a step towards the formation of *hypophosphite of soda* and other medicinal *hypophos-*

phites. It is made much in the same way as phosphoric-acid. Milk of lime is placed in a still (covered by an elephant-head) and boiled. Phosphorus, in small pieces, is then gradually introduced, through a hole in the top of the elephant-head, until a sufficiency has been used. Hypophosphite of lime is formed, and at the same time phosphuretted hydrogen; which latter is allowed to escape freely from the orifice in the top of the still, and is then carried off by the flue. No condenser is employed, or needed.

The other substances are made rarely, and in very small quantities, for the purposes of the organic chemist. *The chlorides of phosphorus*, of which there are two (the *ter-chloride* and the *penta-chloride*), are made by the action of dry chlorine gas upon phosphorus, and by condensing the products. These chlorides very readily decompose, and produce, in decomposing, excessively irritating vapours; which consist, in the case of the ter-chloride, of hydrochloric and phosphorous acids, and in the case of the penta-chloride, of hydrochloric and phosphoric acids. The precautions, however, adopted, are such as to prevent these vapours from ever being inhaled.

5. MEDICAL MEN AND OTHERS.

In reference to those who occasionally, for various minor purposes, use phosphorus, I have nothing special to say—nothing, at least, beyond what will be more suitably brought forward in a subsequent part of this report.

B.—ACCOUNT OF THE DISEASES INCIDENTAL TO THE USE OF PHOSPHORUS.

1. HISTORY.

History of disease of match-makers.

Disease occurring amongst match-makers.—Shortly after the introduction of phosphorus in the manufacture of matches, it began to be observed (especially on the Continent), that a peculiar affection of the jaw was apt to come on, in those who were engaged in the match-factories. Other diseases, also, of a less specific character, were supposed to be prevalent among the same class of people. Various papers, on the diseases of match-makers, appeared in the foreign journals, during the years 1845, 1846, and 1847, recording the experience of several medical men, whose attention had been directed to the subject, and containing the opinions, which they had been led to form upon it. In the year 1847, two German physicians, Von Bibra and Geist, published jointly an elaborate work, founded on original observations and researches, but containing a *résumé* of all that had previously been written on the subject, in which the whole question, in all its bearings, was thoroughly and well considered. From the list of authors cited in this work, it would appear that the first, to call attention to the diseases occurring in lucifer-match manufactories, was Dr. F. W. Lorinser, of Vienna; who published, in the year 1845, an account of 22 cases of jaw-disease, of which the earliest had occurred as far back as 1839. He was followed by Heyfelder, of Nürnberg, and by Strohl, of Strasburg, whose papers appeared in the course of the same year. In 1846, Helft, of Berlin, Roussel and Gendrin, and Sedillot, of Paris, and Dupasquier, of Lyons, published further information on the subject. The exhaustive work of Von Bibra and Geist (above referred to), in which was contained an analysis of 68 cases that had up to that time occurred in Germany, appeared the following year; and was succeeded, in 1852, by a further

2. Phosphorus industry. By Dr. Bristowe

inquiry by the latter of these authors, into the regeneration of the lower jaw after total necrosis. An admirable analysis of the former work appeared in the "British and Foreign Medico-Chirurgical Review," for 1848.

The first recorded case of jaw-disease, occurring in English practice, is described in the "Medical Times and Gazette" for December 19th, 1846 as having been under care in University College Hospital, and is again briefly alluded to, in the Guy's Hospital Reports for 1846–47. Shortly afterwards, cases of the same disease were reported by Taylor of Nottingham, Stanley of St. Bartholomew's, and Simon of St. Thomas's. Subsequently, numerous isolated cases and records of the disease have appeared in various journals, English and foreign. The prevalence of the disease in France is well shown in Chevallier and Poirier's report,* in which it is stated, that out of 60 persons known to have been attacked in France, more than half had died. Its frequency in Prussia is evidenced by the report of "A scientific deputation for medical affairs in Berlin,"† from which it appears that in 75 Prussian manufactories from 35 to 45 cases of jaw-disease had come under notice. Its occurrence in the manufactories of New York is pointed out in the "Medical Times and Gazette" for 1859, vol. 1, p. 400; and its ravages in Zurich are proved by the remarks of Dr. Bilroth, of that city (reported at page 610 of the first volume of the same journal, for the year 1861,) who asserts that there had been for some years past an average of four or five cases per annum, and that during the year, in which his remarks were published, 11 had occurred.

The earlier French writers dwelt on bronchitic affections, as a frequent, and serious, consequence of exposure to the fumes of phosphorus; but Dr. Geist distinctly states it, as his experience, that bronchitic affections are the exception, and that people, engaged in match-making, are not more liable to general indisposition, than the workpeople in other manufactories. This view has been confirmed by subsequent experience; and indeed, the author of the article in the "British and Foreign Medico-Chirurgical Review" somewhat credulously assumes, on the testimony of one of the English workpeople, that a general improvement in health occurs in those entering upon this occupation.

At a meeting of the Paris "Cercle de la Presse Scientifique," held some time during the year 1858, the Abbé Moignot stated that pregnant women, inhaling the vapours arising from phosphorus, are liable to miscarry; and that the fact was so well known to the workers at lucifer-match factories, that many women, with this object in view, purposely exposed themselves to the fumes. He stated, further, that men, by similar exposure, suffered from excessive excitement of the generative function. These statements, however, though perhaps in accordance with preconceived notions as to the effects of phosphorus on the system, are not countenanced by the evidence of any other scientific observer.

The reviewer, before referred to, says, it would be a natural inference, that inconvenience, or disease, would arise from the direct contact of the phosphorus-fumes with the mucous membrane of the eyes; but even this effect does not appear to have been observed.

The only disease, in fact, which prolonged experience has shown to be indigenous in congreve-match manufactories, is that which, from its exceptional character, first drew medical attention to them, viz.,

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* Journal de Chémie Médicale, March 1858, p. 139.

† Vrthjhr. Schr. f. Grchtl. Med. Band, xiii., p. 258.

necrosis of the maxillary bones. It was observed that, amongst those who were employed in the making of matches, and especially among those of them who were most exposed to the fumes arising from the composition employed, some, sooner or later, became attacked with the disease in question; and it was soon established that the proclivity to this disease, though varying in intensity in different manufactories, was a special evil common to them all. The disease, it was noticed, began usually with aching in one of the teeth. At first, this was probably mistaken for an ordinary toothache, and would, indeed, at times intermit. Sooner or later, however, recurrence of pain necessitated the extraction of the tooth, and the pain and annoyance for a time probably ceased. The wound in the gum, however, was found not to heal; offensive matter began to ooze from it, and ere long a portion of the alveolus became exposed. Occasionally, the portion of bone thus denuded came away, bringing with it, perhaps, one or two of the neighbouring teeth, and the disease made no further progress. More frequently, however, the disease continued to spread; and, sometimes slowly, sometimes rapidly, more and more of the jaw-bones became denuded, the gums grew spongy and retreated from the alveoli, the teeth got loose and fell out, the fetid suppuration became more and more copious, the soft parts around grew swollen, tender, and infiltrated, and often the seat of sinuses. And thus, the disease continued to progress, till in the course of six months, a year, two years,—it might be even five or six years,—the patient sank from debility, or from phthisis, or from some other consequence of the local affection; or, having lost piecemeal, or in the mass, large portions—one half, or even the whole—of the upper or of the lower jaw, returned to his original state of good health, but the victim of a shocking and permanent deformity. During the earlier, and more acute, stages of the disease, constitutional disturbance, as might be expected, generally showed itself, indicated by febrile symptoms, loss of appetite, thirst, constipation, a sallow, pasty condition of the skin; and these were often associated with intense pain in the affected parts, and consequent sleeplessness. After a while, however, (especially in cases that were tending to a favourable issue,) pain and constitutional symptoms diminished, and the patient sometimes recovered the aspect of health, even while necrosis of the jaw was still progressing.

As regards the relative frequency with which the jaws were affected, it was observed, that, on the whole, the lower jaw was more frequently the seat of disease than the upper; and this difference (notwithstanding that it was so little, in the cases collected by Von Bibra and Geist, that out of 68 there were 21 in which the superior maxilla alone was affected, and only 25 in which the lower maxilla alone was involved) seems to have been noted by almost all observers. Occasionally both jaws were affected, either simultaneously or successively.

A pathological difference was observed in the progress of the disease in the two jaws. Thus, in the case of the upper jaw, it was, I believe, invariably noted that the sequestrum was bare, and that no new bone was developed around it; that the process of necrosis was unattended by any, the slightest, attempt at repair. In the case of the lower jaw, on the other hand, it was with equal invariability observed that, after the removal of the bone, a framework of new bone was left behind—small and imperfect, it is true, but still replacing, and to a certain extent fulfilling the functions of, the original organ; and it was further observed, that the dead jaw itself was clothed, especially below, with an imperfect layer of slightly adherent new bone. This latter appearance was considered, by Dr. Geist, to indicate, that the disease was essentially, and in the first instance, periostitis; and that the disease and death of the bone were merely a secondary occurrence,—a view which has, I believe, been generally accepted.

When the phosphorus-disease was first observed, various theories of its causation were proposed. Thus, Dr. Jungken maintained that it was only a form of rheumatism, due to working in rooms, overheated, and subject to sudden draughts. This view, however, was quite untenable; for, not only does rheumatism not produce any such affection as that under consideration; but, in Nürnberg, where this opinion had been held, though ample measures were adopted to counteract the causes of rheumatism, the disease still prevailed. Again, Professor Martius, of Erlangen, and Dupasquier, of Lyons, having observed that arsenic was contained in the phosphorus employed in certain manufactories, assumed that this was the deleterious agent. But this explanation, also, admitted of easy refutation; for, as Geist pointed out, not only was this disease unknown among arsenic smelters, but it occurred, and has continued to occur, in factories in which the phosphorus used contained no arsenical impregnation whatever. The *primâ facie* explanation, however, and that which became generally accepted, is, that the disease was due to the inhalation of the fumes of phosphorus. The proofs of this were manifold; 1st, phosphorus was the only article, universally employed in match-making, which gave off vapours, the effects of which had hitherto not been tested by experience; 2nd, those persons, who were most exposed to these vapours, were just those who were found to be those most liable to disease; and, 3rd, it was in those factories, in which the composition employed was richest in phosphorus, and those which were worst ventilated, that jaw-disease chiefly occurred. The experiments, moreover, of Von Bibra on rabbits confirmed the truth of this view. He exposed these animals, for periods varying from eight days to eight weeks, to the fumes of phosphorus; and showed, that under the influence of these fumes in a concentrated form, bronchitis, pneumonia, and gastric disturbance frequently supervened; and that, after lengthened exposure, an eruption of the skin, attended by falling out of the hair, manifested itself. But he observed also (which is more to the point), that after extracting some of the teeth, and partially (by accident) fracturing the jaw, so as to expose the periosteum, then, under the influence of the fumes of phosphorus, changes took place in the jaws of rabbits identical with those which had been observed in the jaws of congreve-match makers.

Yet, although the disease was satisfactorily traced to the fumes which phosphorus emitted during the process of match-making, the precise compound, which acted deleteriously, cannot be said to have been conclusively determined. Von Bibra thought the efficient agent to be hypo-phosphorous acid; but whether it was this specially, or whether it was phosphorous acid, or some other oxide, or all of them indifferently, remained a debateable question.

But it was observed that a small proportion only of those, who were exposed to the fumes, became affected by the disease; and the question—why, of two persons equally exposed, one should suffer and the other should continue healthy—was recognised, therefore, as an important one, and became the subject of investigation. Some supposed that the scrofulous, and weak in health, were specially liable to the disease. Dr. Lorinser considered that the fumes acted by producing, in consequence of absorption, an unhealthy condition of the blood, and that the jaw-disease was simply a secondary effect, brought about, in persons thus infected, by some accidental exciting cause; and, in proof of this view, he drew attention to a peculiar, sallow, bloated complexion, and to a dull expression of eye, which the patients presented, and to the occurrence among them of gastric derangement. These views were adopted by some subsequent observers. Dr. Geist, however, combated them, and contended that the affection was purely a local one, and produced by the direct influence of the phosphorus-fumes on the parts liable to disease. The evidence on this side of the question was that the patients, in the majority of cases, were to all appearance perfectly healthy until the disease manifested itself, and that many of them, even, retained the aspect of health during nearly the whole progress of the disease ; that the jaws, the only bones exposed directly to the fumes, were the only bones that ever became affected ; and, lastly, that the only sufferers were those in whom one or more of the teeth were carious. Dr. Geist came, in fact, to the conclusion, that the phosphorus-fumes acted on the jaw solely through the intermediation of decayed teeth, and brought forward good arguments, and several striking cases, in confirmation of his conclusion. Roussel arrived at the same result. And almost all subsequent writers on the subject, including Mr. Simon, have accepted, or confirmed, the views of these authorities. It may be added, that Von Bibra's previously-cited experiments on rabbits (in the course of which, only those rabbits were affected with maxillary periostitis, in which the jaw-bone had been broken, and the periosteum thus exposed directly to the action of the phosphorus-vapours,) afford additional evidence on the same side of the question. Dr. Bilroth, of Zurich, however, who has had very extensive opportunities of observing the disease, seems to be a dissentient ; for he states, in some observations published early in 1861, that although the disease is not due to any form of cachexia, it is not unfrequently observed in persons with originally remarkably handsome and healthy teeth, and that, why phosphorus specially affects the jaw, is as inexplicable as why mercury affects the parotid, arsenic the stomach, and so forth.

History of phosphorus-disease amongst those who are not match-makers.

Disease occurring among others who have to do with phosphorus.—The disease above described, though found to occur frequently in congreve-match manufactories, and traced in them to the fumes of phosphorus, was not observed among the workpeople engaged in the making of phosphorus, or among manufacturers who employed phosphorus for other than match-making purposes. Several cases, however, were adduced to shew that phosphorus is capable of producing the disease in question, even among those who are not match-makers. Pluskal, for example, published a case, which has been often quoted, to the effect that a young girl, æt. seven, lost several small fragments of the lower jaw from necrosis, which had been induced by the habit of playing with congreves, and watching the phosphorescent appearance produced by them in the dark. The case, however, reads, in my opinion, more like one of noma than one of the genuine phosphorus-disease. A case published by Mr. Simon, and one published by Mr. Paget, both of which are appended to the report, are far more satisfactory and conclusive.

2. PERSONAL INVESTIGATIONS.

Personal inquiries into disease of match-makers.

Disease occurring amongst match-makers.—My own investigations into the health of those engaged in match-making, in English factories, confirm, in almost every particular, the prevailing views with regard to the effect of phosphorus-vapours on health. I found ample proof of the occurrence of necrosis of the jaw, but no proof whatever of the presence, in any unusual degree, of other forms of disease. I discovered here and there a case of epilepsy, here and there a case of rickets, here and there a case of debility or of scrofula, once or twice I met with a case of probable phthisis, and in one or two instances I observed sore eyes; but none of these diseases prevailed; and, manifestly, they were no more common among the work-people, than they would be found to be in any other promiscuous collection of children and adults. I came across one or two, who complained that the fumes of phosphorus affected their breath; but the majority, even of dippers, and of others most exposed, suffered no inconvenience whatever in this respect. And in fact, as might be supposed, the sulphurers complained, far more than any one else, of pulmonary inconvenience. Indeed I have no hesitation in asserting, as the result of my inquiries, that, excepting jaw-disease, there is no form of sickness whatever to which match-makers are specially liable, and that all, both children and adults, enjoy (so far, at least, as outward appearance goes) a condition of quite average health. The dippers, mixers, and foremen, whom I questioned, had most of them been engaged in the business for many years, and had gone through the various stages of the manufacture; yet even among them, with the sole exception above named, there was not, so far as I could discover, anything to indicate deteriorated health.

Considering that the employment of phosphorus, in the manufacture of matches, dates back, in this country, upwards of 25 years, and that there have been, during the greater part of this time, a considerable number of factories in operation, and a large number of hands employed, jaw-disease (if my information is trustworthy) must have prevailed in a far less degree than most persons would have supposed. I have, as before stated, visited as nearly as possible all the match-factories now in operation in England; I have made special inquiries of the proprietors, of the dippers, and of those workmen generally who have been long engaged; and I have taken notes of all the cases that, in their recollection, had come under their cognizance, and have checked, as far as possible, the evidence of one informant by that of another; I have, further, consulted the periodicals, and some of the London surgeons, and have compared the information, thence derived, with that which I have acquired from other sources; yet all the cases of jaw-disease, about which I have received authentic information, amount to 59 only. I do not, of course, believe that this represents the total number that have happened in this country; for, in the first place, although my inquiries have generally been very frankly answered, they have occasionally (rarely) been responded to with an air of reticence that has excited suspicion; in the second place, several of the earlier factories have ceased to exist, or have changed hands, and their experience has been probably to some extent lost; and, thirdly, I have here and there heard rumours of cases, which, though probably founded on fact, I have been unable to verify, and have, therefore, felt bound to disregard. Nevertheless, I doubt very much, whether the whole number of cases, that have occurred, exceeds very materially the number which I have recorded above.

Of these 59 cases, 44 were of males, 15 of females. The disproportion, here shown between the sexes, is somewhat less than might have been supposed, considering the different kinds of duties which males and females for the most part have respectively to perform. It is an important fact, however, to which I shall subsequently recur, that 12 out of the 15 females were infected within the walls of one factory alone.

The ages, at which the disease broke out, varied generally between 18 and 30 years. Four persons became sufferers, after they had passed

40; and, in the factory above referred to, several children, from 12 to 16 years of age, were attacked with the disease.

The occupations, in which the sufferers were engaged at the time of their attack, show unmistakeably how much occupation, and consequent exposure to phosphorus-fumes, have to do with the production of the disease; 36 of the 59 were dippers, mixers, or grinders, or their assistants, who, among other duties, had to frequent the drying-rooms. Of the occupations of three of them I am ignorant. The remaining 20 were boxers, pickers, or cross-cutters. In this last number are included all the young children who have been affected, and almost all the females; and 19 of them belong to the factory, of which I have already had occasion to speak, and in which, for special reasons, others besides the dippers were exposed, in an exceptional degree, to the vapours of phosphorus.

The length of time, during which those who became affected had worked at match-making prior to the commencement of jaw-disease, varied very considerably. In reference to some cases, I was unable to obtain any, or any trustworthy, information on this head. In the great majority of instances, the sufferers had been engaged in match-making for years, and in many cases had dipped or mixed for a considerable length of time. In two cases, however, the disease made its appearance before the completion of 12 months' employment in the business.

The duration of the disease was, of course, determined by a variety of circumstances. Thus, when fatal, it terminated in one or two cases in the acute stage, and at the end of a few months only; in others, at the end of one, two, five, or even twelve years, from exhaustion, phthisis, or some such cause. The date of recovery again presented equal varieties. Thus, for example, in one case, in which a fragment only of jaw came away, the process occupied no more than a few months; but in the majority of cases, a cure was not effected until after the lapse of two, three, four, and even of seven or nine years. A very large proportion of the number attacked ultimately sank. Of the 59 cases adduced, 21 are known to have died of the disease, and 25 to have recovered. Of the remaining 13 cases, 12 are still suffering from the malady, and one has been lost sight of, and of the issue nothing is known.

The lower jaw was affected much more frequently than the upper. In 39 cases the former was the seat of disease, in 12 the latter, and in 5 both upper and lower were simultaneously or successively affected. With regard to 3 cases, the information is imperfect. The necrosis did not necessarily involve the entire bone, even in the case of the lower jaw. Of those who recovered, in whom the lower jaw was the seat of disease, 13 or 14 lost, either large portions of the alveolar processes only, with the teeth belonging to them, or portions of the whole thickness of the bone, but not exceeding one half of the entire organ. In the case of the upper jaw, the disease varied equally in extent; and, in the instances in which it had played the greatest havoc, the whole of the superior maxilla, except the orbitar plates, had been lost.

In respect of the nature of the disease, I believe it to be essentially what Geist, and almost all subsequent writers, have considered it to be, namely, periostitis leading to necrosis. That necrosis is the ultimate result is manifest, as well from the gradual exposure and final separation of the bone, as from the condition of the bone itself at the time of its removal; and that periostitis precedes, and accompanies, necrosis is manifest, equally from the inflamed and suppurating condition which the periosteum presents, and from the constant, but abortive, attempts which (especially in the case of disease of the inferior maxilla) are made at the deposition of new bone.

It has been observed that nothing like regeneration of the upper jaw ever takes place. I have only seen one case, in which this jaw has been actually lost; and certainly there, after the lapse of 14 years, no traces of new bone were discoverable. It has been shown too, by Geist, that after complete removal of the lower jaw, the adventitious jaw, which replaces it, ultimately disappears entirely, or nearly so. I have seen six cases in which the entire inferior maxilla has been lost. In one of these, at the end of eight years, the new bone had dwindled away, till its proportions seemed scarcely to surpass those of the hyoid bone; in one, at the end of five or six years, there was positively scarcely any degree of deformity; and in a third, after ten years, the supplementary bone was as large, and well-formed, as it generally is during the first two or three years after the loss of the maxilla. There would seem, therefore, to be considerable variety in the progress of these cases.

What is the predisposing cause of the jaw-disease?—In answer to this question, I may repeat, that I have entirely failed to detect the existence of any constitutional cachexia, or disorder, attributable to phosphorus-fumes, in those most exposed to their influence; and may affirm, that I have met with no evidence that any kind of ideopathic ill-health had preceded the outbreak of the local disease. Nevertheless, I may mention here a somewhat curious fact, which may seem to throw doubt on the accuracy of the latter observation, viz., that, out of the cases which I have collected, there were eight instances in which two brothers or sisters had become attacked. In the absence, however, of any constitutional disturbance, some local determining cause must exist; and since (as Mr. Simon has pointed out) no similar disease takes place primarily in the bones of the nose, although the schneiderian membrane is exposed equally with the mucous membrane of the mouth to the deleterious fumes, it is natually to some peculiarities in the teeth and gums that attention becomes directed. Ever since the appearance of Von Bibra and Geist's work it has been generally admitted, that the presence of carious teeth is necessary to the production of the disease; that exposure of the tooth-pulp, and through its agency of the periosteum, is a *sine quâ non* in its causation, and that those with quite sound teeth enjoy perfect immunity. This view, however, I am not disposed altogether to accept; for, in the first place, I have obtained abundant evidence, that the existence of even very carious teeth, among those who have been dippers for years, does not ensure for them an attack of jaw-disease; and, in the second place (if the testimony of the sufferers themselves goes for anything), two or three, of those I have conversed with, assert that their teeth, prior to the occurrence of the disease, were excellent—an assertion, which is in accordance with that, which I have already quoted from Dr. Bilroth of Zurich. It is certainly a fact, that the disease does not select, in any special degree, those whose teeth are in a *peculiarly* unsound condition. Of 102 persons, who were acting as dippers or mixers, or who had acted in one or other of these capacities, I found that 63 had, at the time of my examination, carious teeth, and that 39 had sound teeth; but that, among the latter, were several who had had teeth extracted, more than one who had had a tooth or two accidentally broken, and several who had worn away the crown of one or two front teeth, by the constant habit of tobacco-pipe smoking. Now, most of these had worked for many years at match-making, and many of them had been exposed for some years habitually to the concentrated fumes of phosphorus, and yet their jaws remained healthy. In regard to those, again, who had had the disease, I found, certainly, that in the majority of cases in which I was able to make personal inquiries, they had had carious teeth prior to the occurrence of the disease; but they had not had, as a rule, any peculiar degree of caries, nor were they, so far as I could ascertain, those in whom, at the time of the supervention of jaw-disease, the teeth were in the worst condition. It must be borne in mind too, in considering this question, how difficult it is to prove the pre-existence of perfectly sound teeth. The persons affected belong to a class, that habitually pays little regard to the condition of these organs. The disease begins generally with toothache; and they are apt to assume, therefore, that the loose and painful teeth are carious—an opinion which those, under whose care they subsequently come, are naturally ready to adopt. And hence, except in the cases (which must be very rare) in which the patients remain, from the very earliest indications of disease until its character becomes fully developed, under one and the same medical practitioner, it would be almost impossible to prove, that the disease had not been preceded by a carious condition of, at least, one of the teeth. I may add, as bearing on this point, that in a case, appended to this report, which occurred under Mr. Paget's care, of a man who had necrosis of the upper jaw, the teeth, so far as Mr. Paget could ascertain, were perfectly healthy previous to the onset of the disease.

The disease, if we can trust the histories afforded by those who have had it, would seem to commence in at least two or three different ways. In some cases, toothache was the earliest symptom; the tooth was extracted, the wound made in the gum did not heal, and after a time a sequestrum came away. In other cases, a small pimple or gum-boil formed over the fang of one of the teeth, and after a while ulcerated; and the disease spread from that point. In other cases, again, the sufferers state that the disease came on, with general pain in the jaw, of a rheumatic character, attended almost from the first with swelling of the surrounding soft parts. These differences are striking, but do not, of course, of themselves necessarily indicate essentially-different modes of origin; still they suggest them. I must acknowledge, however, that I have not sufficient data before me to warrant me in forming any positive opinion, as to the real nature of the predisposing cause of the disease. But I believe that it consists in some local unhealthy state of the soft parts, such as sponginess or ulceration of the gums, wounds (as those which result from extraction of teeth), gum-disease from mercurial salivation, and the like; and that decayed teeth, if they have any influence, have it simply in consequence of their liability to produce unhealthiness of the adjoining tissues.

As a corollary to the above, I may state, that I found no reason whatever to suppose, that the teeth themselves suffer from the phosphorus-fumes. And although numbers of those engaged have, as I have shown, bad teeth, their proportion is probably not larger than would be found among any equal number of persons of the same age. In corroboration of this statement, I may point out that many, in whom I found the teeth carious, had had them in this condition before they had commenced match-making; and that the great majority of them themselves attributed the caries to natural causes; that among the sufferers from bad teeth, the decay was almost universally confined to the back teeth, which, under ordinary circumstances, are most commonly affected, and which are least exposed to the action of external influences; and that the front teeth, even in cases where they had been accidentally damaged, continued, although chiefly exposed, almost invariably sound and good; and, lastly, that of the dippers and mixers with sound teeth, many had been engaged for years in their employment.

My own inquiries abundantly confirm the received opinion, that the disease must be attributed to the phosphorus-fumes alone; for I found that, with certain exceptions (the consideration of which I have reserved), those, whose occupations specially exposed them, were the ones to suffer. But, although the relative degrees of exposure to fumes, among the workmen of any one factory, must depend on the different branches of the manufacture in which they are respectively engaged, the actual degree of exposure will often depend on other circumstances, such as the species of match manufactured, and the arrangement of the workshops, and their size, in relation to the number of persons engaged, and the amount of business performed, in them. And thus, a class of workpeople, that in one factory is exposed to no danger whatever, in another may be more disadvantageously circumstanced, than even some of those, who are habitually engaged over the dipping-stones. It becomes important, therefore, to look into the relative condition, as regards health, of the different match-manufactories, and to ascertain, if possible, on what any difference, they may present, depends.

In the larger London match-factories, (those, I mean, in which the number of hands constantly employed varies between 60 and 450,) the number of cases of jaw-disease, which, so far as I can ascertain, have occurred, from the commencement of their operations until the present time, has in no instance exceeded four, and in a couple of instances, has not been larger than two. Moreover, in these factories the disease has been limited, with two exceptions only, to the dippers and mixers and their assistants, especially those of them who have to frequent the drying-rooms. But these factories are for the most part well-arranged, well-ventilated, and well-conducted establishments. The dippers and mixers are separated from the boxers and frame-fillers, and work in well-ventilated rooms; properly constructed drying-rooms are provided; bundle-dips are very rarely manufactured, and the proportion of phosphorus contained in the match-composition is small; so that dangerous exposure to the fumes of phosphorus is confined almost exclusively to a very small number of persons, and even these work under comparatively favourable conditions. In most of the smaller factories, both in London and the provinces, the same good arrangements, however, do not exist; and, in proportion to the number of hands employed, the disease has been in them, or at least in some of them, much more serious. Thus, in a small factory in Norwich, in which bundle-dips were manufactured, two brothers, sons of the proprietor, and both of them dippers, were attacked within a very short period of one another. In another small factory, in Nottingham, where bundle-dips were made, three individuals had the disease in the course of several years. In each of two small factories, again, in London, where the inferior class of matches is made, two, if not three, cases of the disease have manifested themselves. In another of the same kind, which has been since discontinued, two cases are known to have occurred. And in another, which ceased operations several years ago, three persons, two of whom were brothers, became affected. Further, the remaining metropolitan cases, which I have collected, were almost without exception, distributed singly among the lower class of makers. By far the most remarkable and instructive experience of the disease, however, is that afforded by a congreve-manufactory, in Manchester, which is one of the largest in England, and in which 250 persons, exclusive of box-makers and splint-cutters, are constantly employed in the various processes of match-making. This factory has been in existence for about 25 years, and during the first 20 years of its operations, no less than 24 cases of jaw-disease occurred. The jaw-disease too, in this case, was not limited, as in most other factories, to the dippers and mixers, and consequently to adults ; but the boxers, the cross-cutters, and the pickers-out, formed a large proportion of those affected ; and children, from 12 to 15 years of age, suffered as well as their elders. The explanation, however, is easy, and was pointed out to me with great candour by one of the proprietors. The fact is, that all those various conditions, which tend to the production of the disease, were here concentrated and combined ; and all the operatives became nearly equally exposed to the fumes of phosphorus. A very large number of workpeople was employed. They were confined in low, ill-ventilated, over-crowded rooms. The dipping, the drying, the boxing, &c. were all carried on in the same apartment. Bundle-dips formed a large proportion of the matches which were manufactured ; and the composition employed contained one-third by weight of phosphorus. Further, at one period (and about that time the disease was most prevalent) the operatives worked far into the night, as well as by day. About five years ago, the proprietors, who had been much concerned by the frequent occurrence of the disease, set to work seriously to remedy the defects on which they believed it to depend. They constructed large, airy, well-ventilated rooms, they gave up the manufacture of bundle-dips, and they diminished by one-half the strength of their composition. The result has been, that not a single case of the disease has originated in this factory, during the five years that have elapsed, since the above improvements were effected. By way of contrast, I may adduce the equally instructive lesson afforded by a large factory in Liverpool. This has been in operation 21 years, and employs between 200 and 300 hands, of whom 150, or more, are engaged in actual match-making, that is to say, in frame-filling, dipping, mixing, and boxing. All these latter work in one room ; and yet, if my information is (as I believe it to be) correct, no case of jaw-disease has ever been known to occur among them. The explanation, however, is not far to seek ; the room, in which the manufacture is conducted, is extremely large (164 feet long, by 32 wide, and proportionately lofty) and thoroughly-well ventilated ; the matches are dried in properly-constructed rooms, which stand apart ; no bundle-dips are manufactured ; and the composition employed contains only one-twelfth by weight of phosphorus. The smell of phosphorus pervading the premises was, when I visited them, remarkably slight. At another well-conducted establishment again, in Birmingham, which has been carried on for nine years, where wax-vestas only are made, and where 150 persons are employed, no disease has yet manifested itself. From the above evidence, it is quite obvious, that the greater the exposure to the fumes of phosphorus, (however that exposure be caused,) the greater is the danger to health ; and that, while it is the easiest thing in the world for a factory to be made a hot-bed of disease, it is little less easy, by adopting precautions, of the simplest and most obvious description, to render the occurrence of jaw-disease therein a rare and quite exceptional occurrence.

With respect to the chemical composition of the fumes, which produce the disease, I have nothing special, or original, to observe ; I agree with previous writers in the belief, that the deleterious influence is due to one or more of the lower oxides—hypo-phosphorous acid, phosphorous acid, and phosphoric oxide—which are evolved copiously during the processes of mixing, dipping, and drying. The direct application of phosphorus was the assigned cause in the first case, that occurred in the Manchester factory. But the direct application of phosphorus implies of course the application, in a concentrated form, of the products of its oxidation.

I may add, finally, that I learnt nothing, in reference to the causation of the disease (nothing at least of value), from the workpeople themselves. A few spoke of decayed teeth, but rather as a cause which had been suggested to them, than as one which had occurred to them spontaneously. Most of them referred the disease to dirty habits, especially to neglect of washing the hands previous to taking meals. Some considered it to be essentially due to frequenting the drying-rooms; and stated that some lads made a habit of eating, and even of sleeping, in them. Many considered the chewing of tobacco, and smoking, as preventives; but, curiously enough, the workmen at Manchester, with whom I conversed, took the opposite view, and thought that those habits tended to the production of the disease.

Personal inquiry into health of others exposed to influence of phosphorus.

Disease occurring amongst others who are exposed to the influence of phosphorus.—As regards operatives, in other than match-factories, who have to do with phosphorus, I have not been able to learn that any of them have ever suffered from disease of the jaw, or from any other affection attributable to the fumes of phosphorus.

In the preparation of phosphorus, as before stated, only two firms in England are engaged, employing between them not more than 60 or 70 workpeople; one would expect, therefore, that even if all the latter were as much exposed to phosphorus-vapours as match-makers are, still very few cases of disease would by this time have occurred among them. But, in fact, the majority of them are engaged in operations, preliminary to the actual production of phosphorus, and are consequently exposed in no degree to its fumes; and the remainder of them, who conduct the later stages of the process, are obviously (as appears from the account which I have given in an earlier part of this report) exposed to the merest traces of such emanations. It is not remarkable, therefore, under the circumstances, that notwithstanding the very large quantities of phosphorus produced, the workmen should have failed to experience the characteristic ill-effects of this agent. In former times, however, when it was customary to mould the phosphorus by sucking it into glass-tubes, considerable danger must have been incurred; but I do not learn that, even then, any cases of the disease were met with. I saw, indeed, an elderly man at Messrs. Albright and Wilson's, who, at the period referred to, was unfortunate enough to suck the phosphorus into his mouth. It stuck among his teeth, and required both time and trouble for its perfect removal. But he experienced no ill-effects.

The manufacture of phosphorus-containing vermin-paste employs very few hands in this country; and here, again, I have reason to believe, that there is very little exposure to the fumes of phosphorus. I am informed by, I believe, the largest maker of this substance in England, that he has never met with the disease; and I have no evidence at all to indicate, that the disease has ever shown itself among any of the workpeople employed.

The manufacture of phosphoric acid, and other chemical preparations which are made from phosphorus, is conducted only by manufacturing chemists, on a comparatively-small scale, and always, I imagine, by the aid of well-contrived apparatus. There need be, and there is, I believe, no exposure to fumes. I have not heard of any disease occurring among the workmen.

But, notwithstanding the favourable experience above recorded, it is obvious, if the fumes of phosphorus are capable of producing jaw-disease, that any who expose themselves to them must be liable to fall victims to their deleterious influence; and hence that, although the liability to disease may by good management be rendered almost nil, no one who has habitually to do with phosphorus can be considered absolutely safe. In proof of this, I may refer to the case, published by Paget, in which disease of the jaw was induced by the taking of phosphorus as a medicine; and to one of the two cases put on record by Simon, in which there is good reason to believe that the disease was caused by the constant chewing of a piece of ginger, which was carried, when not in the mouth, in contact with a bundle of loose congreve-matches.

C.—PRECAUTIONARY MEASURES AGAINST THE OCCURRENCE OF PHOSPHORUS DISEASE.

Precautionary measures.

The special sanitary evil, arising from exposure to the fumes of phosphorus evolved in the process of match-making, is of so serious a nature; that, as soon as its existence was fully recognised, precautions were taken, in the better class of manufactories, with the object of diminishing, and as far as possible of preventing it. And the general result, I believe, both abroad and here, has been a marked diminution of cases of jaw-disease, relatively to the number of persons engaged in match-making.

The precautions, which have been adopted among our English manufacturers, are sufficiently simple; but that their adoption has been advantageous is shown by some of the examples, which I have already adduced. They consist in ventilation, and a proper arrangement, and separation, of the different departments of the manufacture, together with (in one or two instances) enforced cleanliness, and the frequent washing out of the mouth with water, containing alum, or one of the fixed alkalies, in solution. One large firm, that of Bell and Black, make all their hands, who work at the dipping-stones or in the drying-rooms, wear, against the front of the chest, an open flask containing turpentine; and they do not, so far as they can avoid it, employ in these departments any one who suffers from carious teeth. The same firm, moreover, forbid their dippers to work over the dipping-stones for more than a day and a half per week. Precautions like some of the above are taken, I believe, in most of the continental factories. In Prussia, no person with decayed teeth is allowed to enter the factories, and there is enforced a compulsory examination of the health of those who are employed. And, as I am informed by Mr. Albright, in at least two of the German governments, (in order, I presume, to protect the sanitary interests of good subjects,) the criminal prisoners are farmed out for this employment. I propose to discuss seriatim the chief precautionary measures which may be adopted; and, for convenience, shall classify them under the following heads:—

SANITARY ARRANGEMENTS OF FACTORY.—It is important, in the first place, for the sake of reducing to a minimum the number of persons, who need to be exposed to the vapours of phosphorus, that the dipping, mixing, grinding, and drying should be carried on in apartments, separated from the rest of the factory. This arrangement has been carried out, more or less perfectly, in most of the larger and better manufactories.

The rooms, in which the dipping, mixing, and grinding are effected, should be comparatively large, and lofty, and thoroughly-well ventilated; for, by such arrangements as these, the danger to the workmen can certainly be much reduced. But copious white fumes must still be constantly evolved from the heated composition, and, as they diffuse themselves, must still necessarily be inhaled in considerable quantity. To obviate entirely this evil, the only practicable method (as it seems to me) is to have, for the purpose of creating a draught and so of carrying off the vapours, the dipping-stones, and mixing-apparatus, placed under hoods (communicating with shafts), such as are used in chemical, and other, works, which produce offensive or hurtful effluvia. I have seen this plan, efficiently carried out, in one place only, namely, a small, but well-conducted, establishment in Leicester. In one other place, in Manchester, an imperfect arrangement of the kind was in operation.

The drying-rooms should be, as indeed they generally are, fireproof; and no one, but those whose special duties call them there, should be allowed to enter them; and no one, under any circumstances whatever, should be suffered to remain in them longer than is absolutely necessary. I cannot help thinking, however, that some plan might be easily devised, for placing the racks of frames in the drying-rooms, and for subsequently removing them thence, which would obviate the necessity for anyone to enter them at all,—at least, while the process of desiccation is in progress.

As regards the workshops, in which boxing, cross-cutting, and frame-filling are carried on, I need only remark, that they should be large in proportion to the number of persons employed in them, and thoroughly-well ventilated; and that, if possible, (in the larger establishments especially,) the frame-fillers, who are almost wholly children, should occupy separate apartments, and thus be wholly removed from the sphere of influence of the phosphorus-vapours.

RELATIVE AMOUNT OF PHOSPHORUS EMPLOYED.—The sanitary condition of any factory is, as I have shown, much affected by the amount of phosphorus, relatively to other ingredients, used in the match-composition, and also by the character of the matches manufactured. Thus, the making of silent lights, from a very strong paste of phosphorus being employed, is much more dangerous to the operatives than the making of damp-proof matches; and the manufacture of bundle-dips, partly from the same cause, and partly from the fact, that the adhesions between them produced by dipping have to be broken down by rubbing, is much more dangerous than that of frame-dips. Indeed, it is a fact well known to match-makers, that manufactories, in which silent lights and bundle-dips are produced, have a far more powerful odour of phosphorus pervading them, than those in which the better kinds of match alone are made; and all evidence, my own included, testifies to their comparative unhealthiness. It is highly desirable, therefore, that the manufacture of silent lights and of bundle-dips should cease; and, indeed, that the composition, in which the matches are to be dipped, should never be allowed to contain more than about $\frac{1}{12}$th part by weight of phosphorus.

PERSONAL SANITARY PRECAUTIONS.—Personal precautions, especially in the case of dippers and such like, should by no means be neglected; but it is probable, that the efficient carrying out of them will have to depend chiefly on the good sense of the workmen themselves. It is important, that there should be cleanliness; that the men employed should wash their hands before eating, and should take no meal in any part of the factory in which the smell of phosphorus prevails; that they should change their clothes, and wash, on leaving work; and that, as opportunity serves, they should cleanse the mouth with cold pure water, or with a weak alkaline solution. I am inclined to think, too, that the Prussian law, which prohibits the employment of persons with carious teeth, is a good one. I certainly consider that those, especially, should be excluded, who are suffering from toothache, from

III. Industrial diseases.

2. Phosphorus industry. By Dr. Bristowe.

mercurial salivation, who have had teeth recently extracted, or who have the gums ulcerated, or otherwise diseased.

Since, as all evidence seem to show, the fumes of phosphorus act somehow directly, it seems certain, that if the workpeople would keep their mouths shut, and breathe while they are at work solely through the nose, the liability to jaw-disease would almost of necessity cease. Of course, it would be quite Utopian to expect this simple measure to be effectually carried out. But the consideration, on which it is founded, suggests another really feasible measure, which my friend Mr. S. J. A. Salter, in his article on diseases of the jaw-bones, in Holmes's System of Surgery, specially recommends ; it is the wearing of a respirator,— " either one on the ordinary plan, with a sponge dipped daily in one of " the fixed alkalies or their carbonates, or else that devised by Graham " for persons exposed to carbonic acid vapours—it consists of the " mixture of an equal bulk of fresh slaked lime and sulphate of soda, " through a cushion of which it is easy to breathe."

I have mentioned, that one firm make their dippers, and assistants, wear on their chests small narrow-mouthed cups, or flasks, containing turpentine,—the intention being that the turpentine-vapour, mixing with the atmosphere, should prevent the oxidation of the phosphorus. That turpentine possesses this power in a very high degree is undoubted ; but there is equally no doubt that, notwithstanding the adoption of this precaution, fumes appear to be given off, from the melted composition, in much the same proportion as occurs under other circumstances. It seems to me, that if the fumes are to be suppressed, or effectually counteracted, by such measures as this, much more efficient modes of causing the diffusion of the turpentine-vapour should be adopted ; that, for example, the turpentine should be placed, in shallow open vessels, round about the dipping-stone, and should be kept (as indeed it would be kept in that situation) at a comparatively high temperature. It is right to say that the plan, at present in operation, is believed by the workmen themselves to be of beneficial effect ; but, I must add, that it has not been sufficiently long in use to justify any real estimate of its value.

USE OF AMORPHOUS PHOSPHORUS.—But none of the above precautions, nor all of them combined, can equal in importance the substitution of amorphous phosphorus, for the common variety of phosphorus now in use. Amorphous phosphorus is not nearly so readily combustible as the other kind, neither externally nor internally does it act injuriously, nor (what is the point of chiefest importance) does it emit vapours, when exposed to the degree of temperature requisite in the manufacture of matches. It may fairly be assumed, therefore, that it would have no tendency whatever to cause jaw-disease ; and there is no ground at all to surmise, that its use would be attended by special sanitary evils of any other kind. How then is it, that it has not yet replaced the common variety in the making of matches ? The answer I believe is :—1st, that it is considerably more expensive ; and, 2nd, that there are special difficulties in making it available. A relatively high price is likely, I suspect, to be a permanent impediment to its general introduction ; the other obstacle is one, that may very probably be surmounted.

Mr. Dowler, of Birmingham, and Mr. Evans, of Manchester, have, both of them, performed very numerous experiments, with the object of discovering some method, by which amorphous phosphorus might be employed as the active ingredient in the composition for matches ; and both of them have failed in arriving at a satisfactory result. The difficulties which, I believe, in combination, led them to abandon their attempts were :—1st, that a proportionately large quantity of this form of phosphorus had to be employed; 2nd, that, partly on this account, and partly from peculiarities inherent in it, it was difficult to make it combine with the other ingredients; and, 3rd, that, on mixing it with chlorate of potash (without which it is incapable of igniting by friction) a compound was formed of so explosive a nature, as to be highly dangerous to those who had the manipulation of it. Indeed, I was informed, that the workmen ultimately refused to have anything further to do with it; and, that the matches made with it, even, had such a tendency to splutter when ignited, as to be inconvenient, if not dangerous, in use. The reason why this compound, of amorphous phosphorus with chlorate of potash, is so much more explosive than that of the common variety of phosphorus with the same substance, is, as I am informed, that (although the amorphous is naturally less inflammable than the ordinary phosphorus) its pulverulent form ensures for it a much more rapid and complete admixture, and that hence such inflammable properties as it possesses easily become developed to the utmost. It was admitted, however, that the tendency to explosion might be much diminished, if not wholly prevented, by mixing the two substances in a sufficiently moistened condition.

In another way, however, amorphous phosphorus has been employed successfully in making matches. I allude to the method adopted by Messrs. Bryant and May. Their method consists, as previously explained, in mixing chlorate of potash (without phosphorus) in the composition which is employed to arm the matches; and in spreading a layer of composition, containing amorphous phosphorus, but no chlorate, on some portion of the outer surface of the matchboxes. This principle has been carried out, in France, for some years past; and, in barracks and other military establishments there, the use of any other matches than these is interdicted. The object of this regulation, however, seems to be, not so much sanitary as, to prevent accidents by fire. The advantages of this kind of match are, 1st, of course, that in their manufacture, there can be no liability to jaw-disease; and, 2nd, that not being spontaneously combustible, they are not likely to cause fires. But these advantages are conjoined with certain disadvantages, of a minor character it is true, but such as to oppose a serious obstacle to their voluntary adoption by the public. The disadvantages are, 1st, that the matches will only ignite when rubbed on the prepared surface; 2nd, that by careless ignition, the phosphorus-paste on the surface of the box becomes used up long before the matches themselves have been expended; and, 3rd, (I speak now on the authority of other manufacturers, who assert that they have made this kind of match,) that the phosphorus-composition has a tendency to become moist, and thus to deteriorate, with keeping. Messrs. Bryant and May, however, affirm their composition to be permanent.

The practical question still remains:—is it possible, under all the circumstances of the case, by legislation if by no other means, to displace, in the manufacture of matches, the common phosphorus by its amorphous variety? I fear, that a scarcely appreciable difference as to convenience, will be found to operate against the general adoption of matches made on Bryant and May's principle; and, that difference of price alone must always enable the older match to hold its own against its younger rival, whatever form it may hereafter assume, provided the matches made with amorphous phosphorus remain unassisted by any legal enactment. But, in reference to this point, it is worth while to mention that, in the Report of M. Tardieu, published in 1854, in the "Annales D'Hygiène," it is stated, that the French match-makers generally would wish to substitute amorphous, for the other kind of phosphorus, provided its use were made compulsory on all. And I may add, that Mr. Albright, whose opinion on this subject necessarily carries great weight, writes thus : "I am certain, from the countless experi-" ments I have made myself, and from those of others I am acquainted " with, that the difficulties, which have stood in the way of realising " this result, would all yield to a determined effort to insure success ; " and I am convinced, beyond all doubt, that if the use of common " phosphorus could be prohibited, the end would be attained com-" pletely in six months, to the satisfaction of manufacturers and to the " public advantage." The opinion, thus strongly put, is confirmed by that of two of the largest London makers ; both of whom have assured me, that they have succeeded perfectly in replacing the ordinary phosphorus, by the amorphous kind, in the composition in which the matches are dipped, and that the real difficulty in the way of success is solely one of expense.

RESUMÉ OF MORE IMPORTANT PRECAUTIONARY MEASURES.—I have thus passed in review the various precautionary measures, which may be adopted, to obviate the dangers arising from the fumes of phosphorus ; but they are not all equally important, and the adoption of some, indeed, would exclude, to a greater or less extent, the necessity of adopting others. I will, therefore, briefly recapitulate those of them, which seem to me to be of the greatest practical value.

The most important measure of all, and indeed the only perfect one, would be, I repeat, the substitution of amorphous for common phosphorus ; but supposing the employment of the latter to be continued, then,—

1st. The dippers and mixers, and their assistants, should work apart from the other operatives. The rooms, which they occupy, should be well ventilated, and the dipping-stones and mixing-pots should be placed beneath hoods, connected with ventilating shafts.

2nd. Properly-constructed, fire-proof drying-rooms should be provided ; and, if it be impracticable so to arrange them as to allow of their being filled and emptied without the need of any one entering them, those who have to frequent them should, at least, be required to wear respirators, while performing this duty.

3rd. The frame-fillers should, if possible, be separated from the boxers; and the workshops which both, but especially the latter, occupy, should be relatively large, and thoroughly-well ventilated.

4th. Personal cleanliness, including precautions against taking food with unwashed hands, and in places where the smell of phosphorus is perceptible, should, as far as possible be enforced.

5th. It is advisable that those with bad teeth, and especially that those who are suffering temporarily, or otherwise, from inflammation or any other affection of the gums, should, while thus affected, be excluded from those departments in which the fumes of phosphorus prevail.

6th. The manufacture of bundle-dips and silent lights, and generally of matches made with more than $\frac{1}{12}$th part by weight of phosphorus, should be discontinued.

7th. I may add to the above, that matches, of the kind just specified, are manufactured more particularly by the smallest makers, some of whom conduct their operations in their own houses, and in fact in their dwelling-rooms. This domestic manufacture of matches ought to be entirely suppressed ; and, indeed, as regards London, makers of this class, as well as many others, are at the present time acting in direct contravention of the provisions of the Metropolitan Building Act of August 8th, 1844, which enacts, that from that date, it is not lawful "to newly carry on such business in any factory, which is less than 50

" feet from any other building, or vacant land, belonging to any other " landlord, or less than 40 feet from a highway ;" and any such business, already so established, shall be discontinued after 20 years, from the passing of that Act.

D.—NOTE IN REFERENCE TO OTHER INJURIOUS EFFECTS ARISING FROM THE USE OF PHOSPHORUS.

Other ill-effects due to phosphorus.

I have hitherto spoken only of the *maladies resulting from the fumes of phosphorus*, but there are other effects, which phosphorus in substance, either alone or in combination with other materials, is capable of producing, and which, though perhaps not falling directly within the scope of the present inquiry, still demand a few remarks.

Phosphorus, from its ready inflammability when exposed even to a moderate temperature, is, if carelessly handled, liable to produce burns, which, for obvious reasons, are peculiarly intractable. Accidents from this cause, however, in match-making, occur, I believe, rarely ; and, among other reasons, for the obvious one, that few persons, even in a large factory, have the handling of the raw material, or even of the paste in which the matches are dipped. The accidental ignition of matches is scarcely capable of producing serious ill-effects of the above kind.

The combination of phosphorus with chlorate of potash is, when dry, remarkably explosive, and if reasonable precautions be not taken in mixing or handling these ingredients, serious accidents may, as I have previously explained, ensue. Such accidents have occasionally arisen ; but from the facts—first, that trustworthy persons are employed to mix the ingredients ; and, second, that certain rules with regard to the order, and manner, of mixing (which experience has shown to be safe) are followed out—they are really of rare occurrence, and, indeed, need never happen. The frequent explosion of matches, which occurs during the processes of cross-cutting and of box-filling, never leads to any serious results ; and even when, from some mischance, the matches in a drying-room become ignited, and match after match explodes, the conflagration, if such it may be termed, is rarely serious, and if the drying-room be properly constructed, of no moment whatever. Indeed, considering the inflammable nature of the articles employed in match-making, and the carelessness with which the matches themselves are handled, it is remarkable how little danger there seems to be of fire. Within the last few months, it is true, a couple of serious explosions occurred, in quick succession, in one of the largest match-factories in the metropolis ; but the explosions were not due to any of the causes above indicated, and have since been rendered impossible, by carrying on the operations, during which they occurred, by the heat of steam, instead of by the direct application of fire.

The danger, however, to life and property, which the general employment of the ordinary kinds of match entails, is a matter of common experience.

I may here add, that phosphorus has of late years, on the continent, and in France especially, come into use as a popular poison. M. Chevallier, in a paper written in conjunction with M. Poirier, and already quoted by me, has collected 42 cases of poisoning, by this agent, which have occurred in France alone. In this country, however, its use as a poison has been so rare as scarcely to call for notice—one or two cases only have been recorded.

Remedy.

The obvious remedy, for the more serious of the several evils just recounted, is the substitution of amorphous for common phosphorus in the making of matches; and the existence of these evils, furnishes, therefore, an additional argument in favour of this desirable change.

In addition to papers and memoirs, which have appeared, descriptive of the diseases to which match-makers are liable, several reports of commissions have from time to time been issued, with recommendations having reference to the diminution, or prevention, of the occurrence of jaw-disease. Amongst others, I may mention that one was published by the Austrian Government in 1846; that one, to which I have already adverted, was issued in Prussia two or three years since; that M. Tardieu (as the reporter of a commission of eminent men), was the author of one, which appeared in the Annales d'Hygiène for 1854; and, that M. Chevallier has also recently published a document of the kind, in the Journal de Chémie Médicale. Most of the recommendations, however, which have been made (and in some instances adopted) are of a simple nature, having relation chiefly to personal cleanliness, and proper construction of factories. The two last-named gentlemen, however, specially advocate the substitution of amorphous phosphorus, for the kind which is now in common use.

I cannot permit myself to conclude this report, without expressing my acknowledgments to almost all the match-makers, and other manufacturers having to do with phosphorus, for the readiness with which they have given me access to their manufactories, and to their workpeople; and for the valuable information which, in the course of my inquiries, I have received from them. My thanks, however, are especially due to Messrs. Albright and Wilson, of Birmingham, to Messrs. Letchford and Co., Bryant and May, Bell and Black, and Hopkin and Williams, of London, and to Mr. Evans, of Manchester.

SUPPLEMENT.

CASES OF JAW-DISEASE FROM EXPOSURE TO INFLUENCE OF PHOSPHORUS.

A.—*In Match-makers.*

(*The cases marked with an asterisk have come under my own observation.*)

No.	Factory in which Disease was contracted.	CASE.
(1.)	Palmer and Son.	**C. Turner*, aged 33, has worked in this match-factory for 20 years. Began dipping eight years ago. About four years since a little fester formed in the gum over the fang of the left lower canine tooth; this gradually extended, suppuration became established, and 18 months afterwards the lower jaw, (condyles included,) was taken away by Mr. Coote. A hard, apparently osseous, substance now occupies the position of the lost jaw; but this is much

No.	Factory in which Disease was contracted.	CASE.
		smaller than a normal jaw-bone, and, although freely movable, is almost useless in mastication. Had decayed teeth and toothache ever since he can remember. He is now in very good health. A brother of the above, *J. Turner*, aged 31, has also worked in the same factory for 20 years. He is a grinder, and constantly exposed to the fumes of phosphorus. His teeth have been much decayed for years, but he has no affection of the jaw. Enjoys excellent health, but has had three fractures of the thigh during the last eight years.
(2.)	Unknown.	*Long*, a grinder, lost the whole of his lower jaw in Bartholomew's Hospital between 10 and 13 years ago. Was under the care of Mr. Skey, and recovered perfectly. He had worked at Palmer's, but was attacked with the disease at another factory in which he was subsequently employed.
(3.)	Parrott - (*Manufactory not now in existence.*)	**T. Reynolds* alias *Baker*, aged 36, has worked among matches ever since he was a child, and has occasionally mixed and dipped. The disease came on seven or eight years ago while working as a mixer, chiefly for a bundle-dipper named Parrott. It commenced, not with toothache, but with looseness of the teeth, which he attributed to mercury taken by him for a specific cause. Upon this severe pain and swelling on one side of the lower jaw supervened, and soon spread all round. At the end of two years the whole of the lower jaw had come away in two or three fragments. He was under Stanley's care in Bartholomew's. He is now in perfect health. He has scarcely any deformity. A serviceable lower jaw has formed, which is hard and moves freely at the articulations. The teeth in his upper jaw are good, but discoloured with chewing. There is a note of this case in the *Lancet* of June 9, 1855.
(4.)	Baker -	*Baker*, aged 48, has been in business as a proprietor for 20 years. Had bad teeth while quite young. At commencement of business, 20 years ago, was his own dipper and mixer, and made then, as now, silent lights. After two years he suffered from toothache on left side of lower jaw. Great swelling and pain followed, and he was laid up for 13 weeks. A sinus formed, opening externally, and continued to discharge for nine years. At the end of this time a piece of the lower jaw, ½ square inch in area, including the socket of a tooth, came away through the opening, which then healed. He has had fair health since, but has suffered from indigestion. He ceased to mix and dip after the disease showed itself.
(5.)	Baker -	*Rd. Bell* died four years ago, at the age of 22. He had been engaged in the match-business ever since he was eight years of age, and was a dipper for four or five years, working at several factories, but especially at Baker's. He complained, while acting as dipper, of toothache. About six years ago disease in the upper jaw supervened. He attended at two or three hospitals, and about five years since a portion of the bone is said to have been removed at Guy's. He died at home of some internal disease (probably phthisis) a year afterwards, the disease of the jaw still progressing. He is said to have had fair teeth.

No.	Factory in which Disease was contracted.	CASE.
(6.)	Smith - (*Manufactory not now in existence.*)	*J. Bell*, an elder brother of the above, worked for some time with Baker, and now works at Todd's, but became affected 12 or 13 years ago while in the employment of a man at Dover, named Smith. The disease came on when he was about 17 years of age, and followed the extraction of a tooth from the lower jaw, the jaw, it is stated, having been fractured at the time. The lower jaw was removed about 12 years ago at Bartholomew's. During the last six months the superior maxilla has become affected. His teeth are said to have been generally good.
(7.)	Bell and Black.	*J. Osborn*, aged 24, was engaged in match-making 10 or 11 years; was a dipper last two or three years of time, and lived on the premises. About five years ago he had a tooth in the lower jaw extracted for caries. He remained perfectly well, however, for two years. At the end of that time, now three years ago, the jaw-disease began with pain and swelling in the situation of the removed tooth. The jaw gradually became necrosed throughout, and lately was removed by Mr. Adams, of the London Hospital. Two points of interest connected with this case may be mentioned :—1st, after the removal of the jaw profuse hæmorrhage came on, for which the common carotid had to be tied ; 2nd, when the parts had become healed, the dentist was enabled to fix a set of serviceable false teeth to the new bone, which had, as usual, formed in the situation of the old maxilla.—*Medical Times and Gazette*, July 5, 1862.
(8.)	Do. -	*Scott*, who performed the duties of carrying the racks to and from the drying-room, and of cleaning the slab, lost two or three teeth, and a piece of his upper jaw as large as a filbert, about the same time as Osborn, that is, three years ago. He was then about 17, had worked for some years in the factory, and had some bad teeth. He recovered perfectly, and remains well.
(9.)	Halsey -	*F. Sandell*, a man 28 years of age, engaged since he was a child in match-making, and latterly a dipper, lost the whole of his upper jaw except the floors of the orbits. He was in Bartholomew's, under the care of Mr. Wormald, and was operated on in July 1861. He had been ill for about three years, and has since done well.
(10.)	Letchford & Co.	*G. Reynolds* (half brother of T. Reynolds previously named) worked for years in Messrs. Letchford's former factory, where he used to attend the drying-room, and to act also as a boxer. He got necrosis in both upper and lower jaws, was ill 12 months or more, and died four or five years since in Bartholomew's.
(11.)	Do. -	*J. Day*, a man aged 20, but apparently not more than 14 or 15, had worked for years in a match-factory. He was engaged about the drying-rooms, and it is said would often lie down to sleep in them. He was attacked about two years ago with disease in his lower jaw; it commenced with toothache, and went on to total destruction of the maxilla. After about 18 months, and repeated operations for the removal of dead bone, he recovered, and is now perfectly well. Had bad teeth. Was under Mr. Paget's

APPENDIX.

III. Industrial diseases.

2. Phosphorus industry. By Dr. Bristowe.

No.	Factory in which Disease was contracted.	CASE.
		care.—*See Medical Times and Gazette* 1862, Vol. 1, p. 157; and *Lancet*, 1862, Vol. 1, p. 38.
(12.)	Letchford & Co.	*Henry Baker*, about 28 years of age, had been a dipper for some other maker previously, but worked while with Mr. Letchford in the drying-rooms. He was attacked five or six years ago with disease in the upper jaw, and died in Bartholomew's.
(13.)	Do. -	*Matthews* worked in the drying-room, lost a couple of teeth two years ago, supposed to be from the effects of phosphorus, and immediately gave up the occupation.
(14.)	Unknown.	*Storkey* had disease of his lower jaw, lost it, and was perfectly well 12 years ago. He took the disease while working as a dipper for some other maker, but latterly worked at Letchford's. He died two years since of some other disease.
(15.)	Hynam -	*Evans*, aged at the time about 20, assisted in dipping; lost part of his lower jaw, eight or nine years ago I believe, and recovered perfectly.
(16.)	Do. -	*R. Eades*, aged about 20, worked for Hynam seven or eight years ago, and had some swelling and disease of the jaw.
(17.)	Do. -	*Mary Jenkins*, aged 17, applied at Bartholomew's in November 1862, with painful enlargement of right half of lower jaw, associated with offensive smell and decay of all the teeth in this part. She has had toothache for years, and on several occasions abcesses have formed connected with the jaw, discharging offensive pus and small pieces of bone.
(18.)	Martin - (*Manufactory not now in existence.*)	*W. Davis* worked many years ago as dipper for a man named Martin, got disease of lower and upper jaws, and died.
(19.)	Do. -	*Wm. Wildin* died seven or eight years ago of disease of the lower jaw, after a month's illness only. He was 24 years of age, and was at the time working for a man named Martin, a bundle-dip-maker. He had been engaged in match-making for years, and had been a dipper for five or six. He had bad teeth.
(20.)	Hall - (*Manufactory not now in existence.*)	*Flood* worked 18 or 20 years ago for a man named Hall, and had disease of the lower jaw.
(21-22.)	Sutton - (*Manufactory not now in existence.*)	*Two brothers named Sutton* were dippers, and worked at one time for themselves, but afterwards for Warren and Co. Both had, 22 or 23 years ago, disease of the lower jaw. One died of it in some hospital, the other recovered, but died subsequently of some other disease.
(23.)	Do. -	*J. Hillier*, brother of Hillier, at present a manufacturer, died some years ago with disease of the lower jaw. He was quite a young man, and acted as a dipper to the Suttons.
(24.)	Bell and Co.	*W. Davidson*, a man aged 30, was admitted in June 1846 into University College Hospital, having been dipper for six or seven years in a congreve-factory, where he worked often 12 hours daily. His disease commenced about one month before admission with soreness of teeth

No.	Factory in which Disease was contracted.	CASE.
		and jaws. He improved somewhat under treatment and was discharged. In November of the same year he was admitted into Guy's, with abcess over the lower jaw and necrosis of the bone. He left in January 1847 improved, but with the horizontal ramus still diseased. He died subsequently of the disease, having lost half his jaw.—*See University College reports* in *Medical Times and Gazette* of December 19th, 1846, and Dr. Wilks, in *Guy's Hospital report*, 2d series, Vol. xii., p. 163.
(25.)	Bell and Co.	**E. Lockyer*, a married woman, 34 years of age, with three children, has worked at box-filling for five years. Has suffered for years from indigestion, and is subject to pains in chest, and cough, for which she has been a patient at the Brompton hospital. Has had bad teeth for 15 or 16 years. Two years ago an abcess formed in connexion with the left side of the upper jaw, in which part there are still two or three decayed stumps; this never opened into the mouth, but she frequently has discharges of fetid matter, and sometimes of blood, through the corresponding nostril. There is now a hard rounded swelling, occupying the greater part of the left side of the palate, extending from the mesial line to the side so as to involve the alveoli. There is little pain in it even on pressure, but on using pressure pus may be made to escape from the nostril. There is evidently diseased bone.
(26.)	Do. -	*Patrick Nagle*, aged 27, began work 13 years ago in Bell and Co.'s congreve-factory at Wandsworth; latterly he was a mixer. About three years ago he had a decayed tooth, which caused him much pain, and was extracted; soon after this the parts about the lower jaw began to swell, and sinuses formed below the chin and at the upper part of the neck. The teeth got loose, and he pulled them all out with his fingers. The alveoli became denuded. He left off his occupation two years ago, but the jaw-disease has been progressing slowly up to the present time. The whole of the lower jaw, or almost the whole of it, is now bare.
(27.)	Unknown.	*T. Beckingham*, aged 22, was admitted at the end of January 1849 into Bartholomew's Hospital, under Mr. Stanley's care, with necrosis of the left half of the lower jaw. He had been engaged six years in a match-factory as a mixer, and about three years before admission began to suffer toothache. The disease gradually developed itself. While in the hospital the teeth of his lower jaw dropped out; and after a while the whole of the lower jaw except one condyle, which is said to have been absorbed, was removed by operation. The sequel of the case is not given.—*Medical Times and Gazette*, November 17th, 1849.
(28.)	Walker -	**T. Wilden*, a man aged 40, brother of the Wilden before named, was admitted into Bartholomew's on the 6th September 1862, for disease of left side of lower maxilla, with profuse and horribly offensive discharge from the mouth. He remains (December 25th) still under treatment, abcess following abcess, but with no certain indications of necrosed bone. Has worked at match-making for more than 20 years, for 16 of which he has been a dipper. The disease is said to have commenced five months before admission; but its initiatory

No.	Factory in which Disease was contracted.	CASE.
		stage must have been very slightly marked, for only one month prior to his admission into the hospital I saw him at the factory at which he was engaged; and he was then in good health generally, and looked well; and, with the exception of two or three carious double teeth, his mouth seemed in a healthy state. I had reason, however, to believe that he had been suffering a little at times from face-ache.
(29.)	Supposed to be at home.	*Jane Hubbard*, aged 26, applied at Bartholomew's on November 6th, 1862, on account of swelling of left cheek, especially over left side of lower jaw; all her teeth here, and the corresponding upper teeth on this side, were extremely decayed, gums swollen and infiltrated with very offensive pus. She had worked for years in a factory at Bankside as a box-maker, but latterly had, with her husband, been engaged in match-making at home. She had suffered from toothache for years, and from swelling of gums for some weeks.
(30.)	Factory in Newcastle, now belonging to Peel.	**George Bailey*, aged 27, has worked in various departments of match-making since he was quite a child; and for seven or eight years was a dipper at the factory now belonging to Mr. Peel. Two years ago he gave up dipping in consequence of the commencement of jaw-disease, and since that time has worked at box-making. At the time referred to he was attacked with severe pains in the upper jaw of a rheumatic character, together with much swelling of the parts about the jaw, and of the nose. Soon suppuration took place, and the bone began to be denuded. Six months ago, he lost, by operation, a large portion of the left malar bone; a scar and a suppurating sinus have remained there since, and the neighbouring eyelid has become everted. On examining the mouth, a large portion of the upper jaw is found to be necrosed, exposed, and loose. The hard palate itself seems sound and firm, as also do the last one or two molars on both sides, and their alveolar processes. But all the other teeth, at least all that still remain, are loose; and the alveolar portion of the jaw is almost entirely bare, presenting here and there only small still-attached processes of gum. The lip nearly all round has separated from the necrosed bone; and there is also a deep groove exposing bare bone, between the alveoli and the margin of the palate. There is a moderate quantity of purulent discharge, and the breath is very fœtid. His face is ruddy, he is in fair flesh, and looks, and expresses himself as being, in good bodily health. His health, in fact, has been pretty good during nearly the whole of his illness. He says that he had several bad teeth prior to the occurrence of jaw-disease. The teeth in the lower jaw are covered with tartar, so that it is impossible to see if they are quite sound. So far as I can ascertain, however, they are tolerably good. He is in the habit of smoking.
(31.)	Dunn, Norwich. (*Manufactory now belonging to Mr. Lincoln.*)	**W. Dunn*, aged 43, worked among matches for 16 years, during the latter part of which time he was a dipper both of bundle- and of clamp-dips. He gave up all connexion with match-making three years ago. Considers that he enjoyed excellent health, and believes that his

No.	Factory in which Disease was contracted.	Case.
		teeth were sound, up to six years ago. He states that at that time he was attacked suddenly with severe tooth-ache in the last tooth but one on the left side of the lower jaw. It was extracted at the time, and found somewhat decayed. He continued to dip, and the wound made in the gum remained open for 12 months. At the end of this time he had a recurrence of pain in the part, and feeling something sharp there, thought he was cutting a tooth. About the same period he accidentally broke his leg, and was admitted into the Norwich hospital. He was there for two or three months; and shortly after his return home, a piece of bone, the size of the tip of the little finger, came away from the wound in the gum, which immediately healed perfectly. He continued to dip as usual, and for eight or nine months remained perfectly well and free from pain. At the end of this time, or about three years since, he had a fresh attack of toothache in the molar immediately in front of that which had already been drawn. This too was taken out, and found to be decayed. He continued still at his work; but almost immediately, universal swelling about the lower jaw, with suppuration and intense pain came on, and sinuses gradually formed. After a time the disease lost its acute character; and gradually the left half, or a large portion of the left half, of the lower jaw began to necrose and separate. At the present time the piece of bone is really loose, and might be detached readily; but the man has a dread of operative interference, and has allowed the anterior angle of the necrosed fragment of bone to fret a hole in the middle of the lower lip, whence it projects externally for half an inch. The teeth in the upper jaw are discoloured, but seem sound. He has the aspect of perfect health, and, indeed, during the greater part of his illness has enjoyed a fair state of health. He is in the habit of chewing tobacco.
(32.)	Dunn, Norwich.	**Charles Dunn*, aged 23, worked among congreve-matches for 12 months only; that was between two and three years ago, at the time, and chiefly in consequence, of his brother's illness. He dipped. His teeth generally were very good; but he had suffered occasionally from toothache in one of the double teeth on the left side of the upper jaw. This pain recurred whilst he was acting as a dipper; and he had the tooth extracted. The wound continued open, and shortly afterwards several small pieces of bone were removed from it by a dentist. From that time the disease increased gradually (attended by excruciating pain), until at the end of three months the whole of the upper jaw had become involved. After this the pain ceased, and the jaw became by degrees completely denuded. There was never any external swelling, or very little, and never any external openings. The whole of the upper jaw, as seen from the mouth, including the hard palate, is brown, dead, and bare. It is, moreover, loose, and might be readily extracted. But he, like his brother, dreads any operation. The lower jaw is sound, and the lower teeth seem in good condition. His bodily health at present seems to be very good.

No.	Factory in which Disease was contracted.	CASE.
		* The father of the two Dunns worked in the business for 20 years, as dipper and in other capacities; had a few bad teeth during the time, and had them extracted; but never suffered ill-consequences. He is now a healthy old man.
(33.)	Dixon, Son, and Evans, Manchester.	**Devine*, a young man, aged 23, is now a dipper, and has been so for eight or nine years. He is in good health, looks well, and has good teeth in his upper jaw. The lower jaw has been lost, and an imperfect arch of bone, much smaller than the original one, but movable, has formed in its place. The chin retreats very considerably. The disease began when he was 12 years old, while he was acting as a box-filler, and had nothing whatever to do with mixing or dipping. He says that he had at the time a loose milk-tooth in his lower jaw, which one of the dippers tried to remove with dirty fingers, but which had subsequently to be extracted by a dentist. Immediately upon this the jaw-disease began, and rapidly extended. At the end of two years the whole bone had come away, and he was quite restored to health. He has continued in the same business, and enjoyed good health, ever since. Was under treatment at the infirmary.
(34.)	Do. -	**M'Vay*, a female 30 years of age, in fair general health, works now at box-making. The disease attacked her 15 years ago, at which time she was a *lidder*. She had toothache in a decayed tooth of the lower jaw. This was extracted, and immediately afterwards the disease of the jaw spread and became general. The lower jaw was taken away about 10 years ago. An imperfect jaw has formed. One or two wounds still remain.
(35.)	Do. -	**Friory*, a young man aged 21, a boxer. He was a boxer also at the time the disease came on, eight years ago. It began as a gathering about the right angle of the lower jaw; this discharged inside, and about a year ago he lost the right half of the inferior maxilla. He says that he had had two bad teeth in this jaw, but that they were extracted some time before the disease began. Seems to be now in good health.
(36.)	Do. -	*Friory*, brother of the last. He was a dipper, and died five years ago, at the age of about 18. He was ill for about $1\frac{1}{2}$ years with disease of the lower jaw; but he died of debility before it had had time to separate. He is said to have been a delicate youth with fragile bones; that is to say, he had two or three times broken his limbs.
(37.)	Do. -	**Drewry*, a female, aged 21, a boxer. Now in good health. The disease began six years ago, at which time she was also engaged in filling boxes. It commenced with a gumboil on the left side of the lower jaw. The disease extended thence, and at the end of two years she lost the alveoli and teeth of the left half of the bone. The disease went no further. She had had no teeth out when her illness began, and believes they were good at the time. Her remaining teeth are in good condition.
(38.)	Do. -	*Mary Drewry*, sister of Drewry above-mentioned, died in consequence of jaw-disease five years ago, when she was about 20 years of age. She was a boxer, and suffered from necrosis of the upper jaw about $1\frac{1}{2}$ years.

No.	Factory in which Disease was contracted.	CASE.
		She lost five teeth and several pieces of bone, but the separation at the time of her death was not complete.
(39.)	Dixon, Son, and Evans, Manchester.	**M. Mahon*, a young woman aged 23, is now suffering from jaw-disease. She was a boxer when the disease attacked her, now about five years, or rather more, since; and continues to work in that department. It began, rather suddenly, with toothache, and spread gradually until it involved the right half of the lower jaw. The soft structures around are swelled; the bone is now, I believe, entirely necrosed, and apparently in a condition to be readily removed. Her general health at the present time is good. She says she lost no teeth prior to the coming on of her disease. This is the last case which has occurred at Dixon and Evans's factory, and it commenced before their improvements had been carried into effect.
(40.)	Do. -	**B. Glancey*, a woman aged 28, now a box-maker. She was attacked 11 years ago, at which time she was a picker. The disease began with toothache, and a tooth was drawn. In the course of 12 months the right half of the lower jaw came away. She is in good health now, but prematurely old-looking.
(41.)	Do. -	**Burns*, a female, aged 30, a box-maker. She is in good health, but has lost the whole of the lower jaw. There is now scarcely a trace of any solid substance to be felt there, nothing more than a thin hard semicircle, positively not much larger than the hyoid bone. The chin, consequently, is very remarkably shrunk. The disease began 10 or 11 years ago, at which time she was in the family-way, but in excellent bodily health, and had been engaged in the factory less than 12 months. She was then a picker. Her teeth are said to have been good; but the disease began with toothache, for which a tooth was drawn. The disease gradually spread, and in the course of three years the whole of the inferior maxilla came away.
(42.)	Do. -	*Johnson*, a male, a dipper, died from the effects of an accident about nine years ago, when 18 or 19 years of age. He had been a dipper, and for three years prior to his death suffering from disease of the lower jaw attended by external wounds. The disease was still progressing at the time of his death, but his health was mending.
(43.)	Do. -	*Mr. Dixon's nephew.* This was the first case that occurred in the factory. He was a dipper and mixer, about 24 years of age. He had bad teeth, and to cure the toothache a congreve-match was thrust into the hollow of one of those which were decayed. To this the disease was attributed. The lower jaw became necrosed, and he died in the course of 12 or 18 months from debility.
(44.)	Do. -	*Fitzgerald*, a boy of 12 years of age, had disease of the lower jaw, and died from its effects about 12 years ago. The jaw was not lost. He was a boxer or a picker.
(45.)	Do. -	*Mary Noiland*, now married, and mother of a family, was a picker, and was attacked with disease of her upper jaw about six years ago, being at the time 30 years of age. She has left the business some time, but is not yet perfectly well.

III. Industrial diseases.

2. Phosphorus industry. By Dr. Bristowe.

No.	Factory in which Disease was contracted.	CASE.
(46.)	Dixon, Son, and Evans, Manchester.	*Johnson* was a dipper, and was attacked, when between 17 and 18 years old, with disease of the lower jaw. He lingered for 12 years, but did not lose the bone, and died two years ago at the age of 30.
(47.)	Do. -	* *Alfred Johnson,* brother of the last. Twelve years ago, when 13 or 14 years of age, he was working as a boxer at Dixon's. He was attacked with severe toothache in one of the lower molars on the left side. A gumboil formed over the root of the tooth, and continued there for five or six months. A white point formed in it, and suppuration took place. The pain and disease gradually spread all round the lower jaw. He left off working in the factory, and gradually lost two large pieces of his jaw —on the left side the alveoli with four or five teeth, on the right side a smaller piece of bone with only two teeth. The disease then ceased. He has never had any teeth drawn, but he had a bad tooth in the affected jaw before the disease began. He is now working (not exposed to phosphorus-fumes) in Russell's factory at Leeds. He is in excellent health, but has several bad teeth, and the gaps in the jaw resulting from his disease are very apparent on looking into the mouth. This man and another, (also now working at Russell's,) both of whom had previously been employed for years at Dixon's, confirmed Mr. Evans's account of the foregoing cases, and supplied the following nine in addition.
(48.)	Do. -	*John Cremer,* a dipper, died four years ago, at the age of 34, with disease of his lower jaw, having been ill for two years. The jaw was not removed. He is said to have had good health at the time, and to have had good teeth.
(49.)	Do. -	*B. Fallen,* a female, worked at boxing, and died five years ago, aged 18. She was ill for a year with disease of the lower jaw. The jaw did not come away. She died at home.
(50.)	Do. -	*Winifred Gaitley,* a married woman, a picker, was attacked six years ago with disease of the upper jaw, and died, aged 40, three years ago.
(51.)	Do. -	*John Drew,* a cross-cutter, now 28 years of age and perfectly recovered, was attacked seven years ago with disease in his upper jaw; he lost a large part of the upper jaw and the "socket of his eye." He was ill for two years and a half.
(52.)	Do. -	*A. Farrell,* a young woman aged 22, died eight or nine years ago. She was a picker, and had disease in her lower jaw; she died of its effects in 18 months.
(53.)	Do. -	*B. Ryan,* a boxer, was taken ill 12 years ago, when she was 14 years of age. Her lower jaw became affected, but what became of her is unknown; she had only worked for a short time.
(54.)	Do. -	*G. Davis,* a male, was attacked 18 years ago with the disease. He was at that time 14 years of age. He lost one side of his lower jaw and recovered completely. This was the second case that occurred at Dixon's factory.

APPENDIX.

III. Industrial diseases.

2. Phosphorus industry. By Dr. Bristowe.

No.	Factory in which Disease was contracted.	CASE.
(55.)	Dixon, Son, and Evans, Manchester.	*Reynolds*, a boy, 14 years of age, died 10 years ago of disease of his upper jaw, from which he had suffered for about two years. He had been a boxer.
(56.)	Do. -	*M. Fannan*, a female, had disease of lower jaw and died.
(57.)	Cooke, Nottingham.	* *W. Cooke*, a manufacturer of congreves, at Nottingham, employing at times 20 hands, and making both bundle- and frame-dips. He used to mix and dip. About 15 years ago, having then worked for eight years on his own account as a dipper and mixer, he was attacked with severe pain in his upper teeth (one or two of the back ones were carious). Much swelling and discharge ensued; and at the end of two years he had lost bit by bit all his upper teeth with their sockets, and portions of the superior maxillary bones reaching up to the nose in front. The roof of the mouth remained. The disease during this time attacked also the lower jaw; and about 12 months later the teeth and alveolar processes of this jaw also came away. The rest of the bone remained healthy. He continued a match-maker, though not a worker in the factory, until three years ago. He has enjoyed excellent health ever since. I saw him in October last, aged 62, and found him well; but, as might be supposed, his mouth was remarkably sunken, and he had consequently the aspect of being considerably older than he really was.—*See Mr. Taylor's Paper, Lancet*, Nov. 10, 1849.
(58.)	Do. -	* *James Brewerton* was admitted into St. Thomas's under Mr. Simon's care, July 31st, 1849. He was then 46 years of age. He had commenced the manufacture of congreves in 1837, and mixed and dipped. In 1845 he devoted himself to making fuzees instead, and continued to do so until 1848; during this latter time he first complained of toothache and caries. At Christmas, 1848, he went to Nottingham, to assist Cooke, who was then laid up. In May 1849, severe toothache came on and some of the teeth were extracted. From this time the disease gradually spread, and nearly the whole bone (including its rami) perished. After the patient had been more than a year in the hospital, Mr. Simon sawed through the large sequestrum in the middle line, and, without any incision of soft parts, removed it in two pieces from within the mouth. Soon afterwards (Oct. 29) the patient was dismissed well, and with the usual supplemental jaw. He soon after sailed for Australia, and has not been heard of since.—*See Mr. Simon's Lecture, Lancet*, 1850, Vol. 1, p. 41.
(59.)	Do. -	*A third case* of the disease occurred in Cooke's factory. This was in a boy who acted as assistant dipper; he was ill two years, lost part of his jaw, and died of some internal disease, probably consumption. His death took place about two years ago at the age of 17 or 18.

B.—*In those who are not Match-makers.*

No.	CASE.
(60.)	*L. G. F. H.*, a framework knitter, was admitted under Mr. Simon in the latter part of 1849. He was 36 years of age, and a native of Nottingham. He had, on admission, ulceration at the left angle of the mouth, extending down to the gums. All the teeth of the lower jaw, with the exception of the last molar on the right side and one of the bicuspids, had disappeared, together with their alveolar processes. The gums were still ulcerated. He had had syphilis 17 years before, and nine years afterwards some cutaneous disease. In 1846 he seems to have had some ulceration of the mouth, and a year or two ago symptoms like those of phthisis. Early in 1849 a friend recommended him to keep a piece of ginger in his mouth, which he did, by placing it in the front of his mouth just within the lower lip. He carried it at other times in his waistcoat pocket, together with half a box-ful of loose matches. He continued to chew for three weeks. A few days after he first began the practice, he observed that the ginger had a disagreeable taste of phosphorus; but he did not heed this till, at the end of two weeks, he felt a gentle stinging in the gums corresponding to the front lower teeth. The stinging increased day by day, especially in the situation of the two right bicuspids, which were carious, and indeed his only carious teeth. In April the teeth and their alveoli began to come away, and the disease gradually extended, until all the alveolar processes and teeth, excepting those above mentioned, were lost. He was put on a course of iodide of potassium, and went out well shortly before the case was published.—*Mr. Simon's Lecture, Lancet*, Vol. 1, 1850, p. 41.
(61.)	*James Hayes*, a man aged 34, was admitted into Bartholomew's in October 1861, for necrosis of the palatine and alveolar portions of both upper maxillæ. The whole of the necrosed bone was removed in one piece by the forceps. He had never been engaged in any business in which phosphorus was employed; but for three or four months previous to the commencement of his illness he had taken phosphorus internally, which he had been taught to prepare for himself—his method being uncertain, but always attended with the production of fumes. So far as could be ascertained his teeth had been sound. He had never had syphilis or taken mercury.—*Mr. Paget's Lecture, Medical Times and Gazette*, Vol. 1, 1862, p. 41.

IV. Cattle diseases in relation to supply of meat and milk. By Mr. Gamgee.

IV.—CATTLE DISEASES IN RELATION TO SUPPLY OF MEAT AND MILK.

PROFESSOR JOHN GAMGEE'S REPORT ON THE DISEASES OF LIVE STOCK IN THEIR RELATION TO THE PUBLIC SUPPLIES OF MEAT AND MILK.

I.—PRESENT AMOUNT OF FATAL CATTLE DISEASE IN THE UNITED KINGDOM.

Amount of live stock in the United Kingdom.

Reliable statistics as to the amount of live stock in Great Britain are wanting, and no official returns have ever been obtained in the United Kingdom as to the losses sustained by diseases amongst our domestic animals.

In 1854 it was estimated * that in

England and Wales the number of cattle amounted to	3,422,165
Scotland (latest statistics 1857) - - -	974,437
Ireland (statistics for 1862) - - -	3,250,396
Total horned cattle in the United Kingdom -	7,646,998

Value of horned cattle.

The nearest approximation I can give of the value of this stock is 10*l.* per head. The stock lost is always the best, and, according to insurance statistics, amounts on an average to 11*l.* 10*s.*

The number and value of horned cattle thus accepted for the purposes of this report is, in my opinion, decidedly below rather than above reality.

The statistical information as to losses on the above stock is derived from personal experience, and from unpublished insurance statistics which can be thoroughly relied on, supported as they are in a very significant manner by the history of live-stock insurance offices since their origin in 1844.

Prior to 1842 the average mortality amongst our cattle could not be estimated at more than 1½ to 2½ per cent., but rumours then spread as to cattle plagues abroad. Reports of terrific losses reached this country, and the warning was followed by the introduction of epizootic aphtha and pleuro-pneumonia. The first was called the "epidemic," and the second the "new disease," the chief difference between the two being that the epidemic deteriorated stock, whereas the new disease destroyed it.

Institution of cattle insurance offices.

Necessity for such societies never felt before the importation of diseases.

Inquiries were set on foot as to how the calamity should be met. Insurance societies had been established abroad, and similar associations were then considered indispensable here. This need, be it observed, was only felt after our ports were opened to foreign animals. Then inquirers proceeded abroad to learn the working of such companies; returns were obtained from all sources; and it was estimated that between two and three per cent. would cover the heaviest losses ever sustained throughout a country.

First cattle insurance company established, 1844.

Farmers' and Graziers' Cattle Insurance Company.

Its bankruptcy.

In 1844 the first English insurance society was established. It bore the name of "The Farmers' and Graziers' Mutual Cattle Insurance Company." Its patrons were wealthy and influential; its members were soon very numerous; the insurances effected attained vast proportions, and under the most favourable conditions, as many people were then more alarmed by continental reports than injured by disease at home. Pleuro-pneumonia, however, cleared out stock after stock and herd after herd in an incredibly short space of time. The company raised its rates of premium repeatedly. Disease, however, continued, and the affairs of

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* Parliamentary Paper.

this first mutual society became hopelessly embarrassed. Its books were closed four or five years after it was first established, and many have not received to this day heavy sums in compensation for losses amongst insured stock.

United Kingdom Mutual Cattle Insurance Company.

The apparent early success of the above company led in 1845 to the organization of "The United Kingdom Mutual Cattle Insurance Company." Its business was good, but the same disasters naturally befell it as the sister company, and it was obliged to yield under the pressure of enormous liabilities it had incurred and could not meet.

In England and Scotland alone two millions' worth of live stock were insured in the first two years of the existence of the before-mentioned companies. There was an unlimited amount of business to do, but the larger the transactions the sooner could it be perceived that persistence implied ruin.

Renewed inquiries as to mortality with a view to establish companies on a better basis.

Agricultural Cattle Insurance Company, 1845.

As mutual associations could not succeed, enterprising individuals resolved to obtain more correct information as to the real mortality amongst cattle; and to have a large reserve fund to meet any emergency that might arise. Accordingly in 1845 was published the prospectus of "The Agricultural Cattle Insurance Company," which was to be a proprietary association, with a capital of 500,000*l.* Expectations were as high on the part of the public as amongst the shareholders. The large capital, the absence of all copartnery risks, the still moderate rates of premium, and the alarming losses by disease, led to a very active trade. The business attained truly enormous proportions, and insurances were effected at the rate of 300,000*l.* weekly for a considerable length of time. At the completion of the third year of this society's existence, ten millions sterling was the value of stock insured by it. No other provident institution in the world ever had such a business. But cattle were dying. The hurricane which swept away the earlier companies did irreparable damage to the new one. The annual report for 1848 says, referring to the lung disease in cattle, "that in some districts "thousands were carried off; so great, indeed, were its ravages, that "nearly three-fourths of the losses for which claims were made upon "the company were the results of that incurable disease." The shareholders were summoned to meetings; call after call succeeded at short intervals; the rates of premium were raised, and the confidence of the public began to be shaken. All claims, however, were met, business again increased, but disease did not abate. The losses incurred during the first years could never be made up, and struggling on under great difficulties, this, the greatest cattle insurance company that had ever existed, held out for 17 years, but was compelled to wind up its affairs in 1861. Nor was this all. During the period of the apparent successes of the company other associations of the same character had been established. In 1846 "The Scottish Agricultural Cattle Insurance Company;" in 1851 "The Essex Cattle Insurance Company;" "The Bury Local Society;" "The Bouldsworth Cattle Insurance Association;" and "The Ecclestone Insurance Company." And these companies, one by one, had joined the "Agriculturist," so that when it ceased to exist, it was not one, but six companies in one, which were annihilated entirely in consequence of the continuance of a frightful mortality amongst cattle. It deserves notice that several times in the history of the "Agriculturist" company, its Irish business was given up on account of the especially heavy losses which it entailed.

Report for 1848.

Wound up in 1861.

Amalgamation of many companies.

It is an instructive fact that insurance offices, after having calculated that their utmost possible losses would be coverable by a premium of $3\frac{1}{7}$ per cent., eventually exacted premiums of more than double that amount, and yet came within a few years to ruin. No better proof can be given that the statements I have now to make are justified by the facts.

APPENDIX.

IV. Cattle diseases in relation to supply of meat and milk. By Mr. Gamgee.

I am in a position to publish statistical tables carefully prepared by Mr. Francis McMinn,* late superintendent for Scotland to the Agricultural Cattle Insurance Company.

STATISTICS. LIVE STOCK. CLASS CATTLE.

TABLES showing the nature of risk on each particular class of Cattle, with the rate of mortality thereon, carefully compiled from actual results upon policies of insurance in various counties of Scotland.

No. I.—DAIRY COWS.†

Years of Business.	Number of Animals insured.	Value of Animals insured.	Number of Animals lost.	Value of Animals lost.	Rate percent. loss.	Average Value of Animals insured.	Average Value of Animals lost.
		£ s. d.		£ s. d.		£ s. d.	£ s. d.
1855 - -	1,634	19,822 14 0	114	1,405 4 0	6·976	12 2 7	12 6 6
1856 - -	2,464	28,899 0 0	201	2,351 0 0	8·127	11 14 6	11 13 11
1857 - -	2,809	34,341 0 0	123	1,563 0 0	4·378	12 4 6	12 14 2
1858 - -	4,311	50,372 10 0	253	3,078 0 0	5·869	11 13 8	12 3 4
1859 - -	3,113	36,866 17 0	127	1,499 10 0	4·079	11 4 0	11 16 1
1860 - -	2,283	26,820 0 0	118	1,536 0 0	5·168	11 14 11	13 0 4
Six Years, 1855–60	16,614	197,122 1 0	936	11,432 14 0	5·634	11 17 3	12 4 3

† No reference is made here to town dairy cows. The mortality among these is so great that after several years' experience, and at high rates of premium, insurance of them had to be given up. Those, therefore, taken into account are country cows, kept on farms for breeding purposes and for production of cheese and butter.

No. II.—HEIFERS AND QUEYS.‡

Years of Business.	Number of Animals insured.	Value of Animals insured.	Number of Animals lost.	Value of Animals lost.	Rate percent. loss.	Average Value of Animals insured.	Average Value of Animals lost.
		£ s. d.		£ s. d.		£ s. d.	£ s. d.
1855 - -	188	1,598 8 0	4	43 0 0	2·128	8 10 0	10 15 0
1856 - -	242	1,941 0 0	7	90 0 0	2·892	8 0 5	12 17 1
1857 - -	341	2,570 4 0	9	69 0 0	2·639	7 10 9	7 13 4
1858 - -	370	2,853 0 0	17	126 0 0	4·595	7 4 3	7 8 3
1859 - -	535	4,230 10 0	13	106 10 0	2·429	7 18 1	8 3 10
1860 - -	219	2,058 10 0	3	29 0 0	1·369	9 7 11	9 13 4
Six Years, 1855–60	1,895	15,251 12 0	53	463 10 0	2·796	8 0 11	8 14 10

‡ Young cattle, from one year old and upwards, until they have their first calf, or until set apart to be fed for market, are here called queys or heifers; and being generally reared upon the farm on which they were insured, the risk was not counted so doubtful as on cattle driven about to public markets.

No. III.—CALVES.§

Years of Business.	Number of Animals insured.	Value of Animals insured.	Number of Animals lost.	Value of Animals lost.	Rate percent. loss.	Average Value of Animals insured.	Average Value of Animals lost.
		£ s. d.		£ s. d.		£ s. d.	£ s. d.
1855 - -	256	1,690 0 0	29	182 8 0	11·328	6 12 0	6 5 9
1856 - -	387	2,244 10 0	15	89 0 0	3·876	5 16 0	5 18 8
1857 - -	325	2,016 10 0	14	115 0 0	4	6 4 1	8 4 6
1858 - -	512	3,059 10 0	25	140 10 0	4·882	5 19 6	5 12 5
1859 - -	655	2,871 2 0	39	166 3 0	5·954	4 7 8	4 5 2
1860 - -	149	1,001 0 0	6	38 0 0	4·027	6 14 4	6 6 8
Six Years, 1855–60	2,284	12,882 12 0	128	731 1 0	5·604	5 12 9	5 14 3

§ This class is taken from six months till one year old. About the time when they are taken off the milk a much greater number die than is here given as the average. To avoid this our rule was to take none under six months old; for at that time a considerable part of the risk, relating to that change, was over. On calves allowed to suckle the dam the loss is trifling.

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* I believe Mr. McMinn to be the best authority in this country on agricultural insurance. I have had ample opportunities to satisfy myself that his tables indicate correctly the mortality amongst cattle in Scotland, and that it is very safe to apply conclusions arrived at by Mr. McMinn in Scotland to the whole United Kingdom.

No. IV.—TWELVE-MONTH FEEDERS.*

Years of Business.	Number of Animals insured.	Value of Animals insured.	Number of Animals lost.	Value of Animals lost.	Rate percent. loss.	Average Value of Animals insured.	Average Value of Animals lost.
		£ s. d.		£ s. d.		£ s. d.	£ s. d.
1855 - -	616	6,548 0 0	70	885 0 0	11·364	10 12 7	12 12 10
1856 - -	618	6,103 10 0	31	288 10 0	5·032	9 17 6	9 6 1
1857 - -	575	5,748 0 0	18	209 0 0	3·147	9 19 11	11 12 2
1858 - -	465	4,802 0 0	33	266 0 0	7·096	10 6 6	8 1 2
1859 - -	527	6,216 0 0	18	214 0 0	3·415	11 15 6	11 17 9
1860 - -	442	4,973 10 0	20	225 0 0	4·524	11 5 1	11 5 0
Six Years, 1855-60	3,243	34,391 0 0	190	2,087 10 0	5·858	10 12 1	10 19 7

* Feeders, or fattening cattle, are divided into two classes, the one termed twelve-month feeders, the other six-month feeders. The former are generally wintered upon straw and a few turnips, then turned out to graze during summer, and afterwards brought in for from three to six months to be fed on turnips and oilcake. The greatest mortality is generally during the first six months.

No. V.—SIX-MONTH FEEDERS.†

Years of Business.	Number of Animals insured.	Value of Animals insured.	Number of Animals lost.	Value of Animals lost.	Rate percent. loss.	Average Value of Animals insured.	Average Value of Animals lost.
		£ s. d.		£ s. d.		£ s. d.	£ s. d.
1855 - -	1,133	14,795 0 0	44	504 0 0	3·883	13 1 11	11 9 1
1856 - -	1,401	18,468 5 0	35	467 0 0	2·134	13 3 7	13 6 10
1857 - -	1,017	14,337 0 0	39	629 0 0	3·834	14 1 11	16 2 7
1858 - -	1,208	15,133 10 0	25	337 0 0	2·069	12 10 6	13 9 7
1859 - -	750	8,790 0 0	11	119 0 0	1·466	11 11 9	10 16 4
1860 - -	444	5,680 0 0	13	155 0 0	2·928	12 15 10	11 18 5
Six Years, 1855-60	5,953	77,203 15 0	167	2,211 0 0	2·805	12 19 4	13 4 9

† This class is generally in fair condition when brought in, and the risk is not so great. As above stated, the first six months are the worst. Were they kept on for a year, the loss would probably be not more than 4 per cent., or, at the greatest, 5 per cent.

On the preceding sheets the class Cattle has been divided into five separate tables, each table containing a separate division of that class, principally to show the nature of the risk, it being evident that all these divisions are not alike healthy or alike subject to disease. The following Table contains the sum of each of the divisions referred to, and among other things brings out the general average mortality among cattle of every description in the Kingdom.

No. VI.—SUMMARY OF THE PRECEDING TABLES.

Description.	Number of Animals insured.	Value of Animals insured.	Number of Animals lost.	Value of Animals lost.	Rate percent. loss.	Average Value of Animals insured.	Average Value of Animals lost.
		£ s. d.		£ s. d.		£ s. d.	£ s. d.
Dairy cows -	16,614	197,122 1 0	936	11,432 14 0	5·634	11 17 3	12 4 3
Queys - -	1,895	15,251 12 0	53	463 10 0	2·796	8 0 11	8 14 10
Calves - -	2,284	12,882 12 0	128	731 1 0	5·604	5 12 9	5 14 3
Feeders for 12 months -	3,243	34,391 0 0	190	2,087 10 0	5·858	10 12 1	10 19 7
Feeders for 6 months -	5,953	77,203 15 0	167	2,211 0 0	2·805	12 19 4	13 4 9
	29,989	336,851 0 0	1,474	16,925 15 0	4·915	11 4 7	11 9 8

Mr. McMinn says "the results thus exhibited are taken from tables
" drawn out on a more extensive scale than those here given, and were
" originally intended to ascertain from actual results what rate of
" premium was necessary to cover the loss annually arising among
" horses and cattle in Scotland. These figures therefore so collected.

Rate of loss is presumed to be much above rather than under 5 per cent.

and now produced in the above table, show what the loss at its lowest estimate really is, for it is presumed that the rate per cent. of loss is considerably above, instead of under, 5 per cent. Many cattle which were proposed for insurance were rejected on account of being diseased at the time of proposal, therefore the loss on these is not ascertained, neither is the loss on calves before they reach the age of six months taken into account. Both of these causes in the absence of others will doubtlessly increase the rate stated above. The risks undertaken as shown in the above table covered nearly 30,000 animals, and value to the amount of 336,851*l.*, from which value it is evident that 16,925*l.*, or nearly one-twentieth part of the whole sum, is lost annually by death from disease, accident, or other like causes.

Confirmatory results.

Average loss on stock in Scotland proved to be about 5 per cent.

"It should be remarked here, however, that these calculations are not formed from risks undertaken in any certain locality or selected part of country, but from those spread over almost every county in Scotland, and the results from them therefore are not local but general results taken over a wide field. So late as 1861 the compiler, desirous to test his own figures, called for the previous five years' returns from local agents and inspectors in Scotland; and comparing these with his own found the total loss on cattle to be 4·813 per cent. over the kingdom; the fractional difference was so small, and approaching so very near to the rate mentioned above, that he has no difficulty in concluding as a fact established that the average loss on the whole stock kept in Scotland is about 5 per cent. annually.

"The latest agricultural statistics belonging to Scotland which we have were published in 1857.* In them we have given the number of animals comprehended under the name of live stock, and can therefore, taking the above data as a rule upon which to proceed, find the value, annual loss, and rate of mortality in Scotland as particularised in the following table:—

No. VII.

Description.	Ascertained Number of Cattle in Scotland.	Estimated Value of Cattle in Scotland.			Estimated Number lost annually.	Estimated Value of Cattle lost annually in Scotland.			Rate per cent. loss.
		£	s.	d.		£	s.	d.	
Dairy Cows - -	303,912	3,605,156	2	0	17,122	209,135	7	0	5·604
Other Cattle - -	475,327	5,504,511	6	3	19,831	238,467	15	6	4·172
Calves - - -	195,198	1,100,428	14	6	10,940	62,481	18	8	5·604
	974,437	10,210,096	2	9	47,893	510,085	1	2	4·915

"The number of cattle which die annually in North Britain is thus discovered to be 47,893, and the money value of them to exceed 500,000*l.*, a large number and a large sum, and evidently too large to pass unnoticed as it does. The consideration as to whether there be not an unnecessary waste of life and money, and whether both might not be lessened to some extent, ought certainly to find a place in the discussion of agriculturists, and in the study of professional men, particularly when little doubt exists as to the fact that a very large proportion of the loss arises from diseases not native to the country. Above one half of the total number lost is by pleuro-pneumonia, a disease which was unknown in this country before 1840.

One half of the loss due to foreign diseases.

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* Return to Parliament by Mr. Hall Maxwell.

IV. Cattle diseases in relation to supply of meat and milk. By Mr. Gamgee.

Losses greater in England and Ireland than in Scotland.

"But, compared with England or Ireland, the loss in Scotland is "small. In Ireland disease it is understood has always prevailed to a "much greater extent, and some years ago it was excessive. Two or "three attempts have been made to establish the usual system of in"surance among cattle there, but as often have these attempts been "unsuccessful. Though high rates of premium were charged, yet "these were inadequate to meet the increased mortality, and the "insurance companies were beaten off again and again with great loss. "Looking to the agricultural statistics of Ireland for the year 1861,* "we find that there are 3,468,058 cattle in that part of the United "Kingdom, and calculated according to the rates assumed by the "Census Commissioners of 1841 to be worth 22,542,377*l.* This "valuation must be at least 20 per cent. under the present value, but "for the sake of calculation assuming it to be correct, and taking the "rate of mortality from our Scotch tables, which are low rates for "Ireland, we find the annual loss to be 1,132,687*l.* 7*s.* 5*d.* In these "two kingdoms, therefore, we have an annual drain upon agricultural "capital amounting to 1,642,771*l.*, or taking the real value of Irish "cattle, close upon two millions each year.

Scotland the most desirable of the three kingdoms to take risks in.

"I have not before me any statistics of stock in England, and, there"fore, cannot interfere with that kingdom. The cattle there are "larger and more valuable than in either Scotland or Ireland, but it "is not supposed the average loss per cent. can be less, so far as "insurance companies are concerned. Scotland is a desirable country "to take risks in, being the safest, and less loss arising there."

For the purposes of this report it is important to ascertain which diseases are most destructive amongst animals; and I therefore subjoin a very important table showing the diseases by which animals have died in Mid-Lothian during three whole years:—

DISEASES by which Animals have died, principally in MID-LOTHIAN, during the last Three Years.†

DISEASES.	1859.				1860.				1861.				TOTAL OF THREE YEARS.			
	Horses.	Cows.	Feeders.	Calves.	Horses.	Cows.	Feeders.	Calves.	Horses.	Cows.	Feeders.	Calves.	Horses.	Cows.	Feeders.	Calves.
Accident - - -	10	7	3	.	7	8	2	1	11	3	6	2	28	18	6	3
Ruptured stomach -	4	2	.	.	5	1	.	.	6	2	.	.	15	5	.	.
Indigestion or colic -	34	13	2	.	29	17	5	1	24	11	1	.	87	41	8	1
Inflamed lungs - -	3	6	.	.	6	6	1	.	2	2	.	1	11	14	1	1
Inflammation of womb	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.
Inflamed kidneys -	1	.	.	1	1	.	.	.	.	2	.	.	2	2	.	1
Milk fever - - -	.	17	.	.	.	13	.	.	.	13	.	.	.	43	.	.
Fardlebound - -	.	4	2	.	.	.	2	.	.	2	2	.	.	6	6	.
Internal hæmorrhage	.	.	.	.	.	.	.	.	2	1	.	.	2	1	.	.
Paralysis and palsy -	3	3	.	.	4	2	2	.	3	2	.	.	10	7	2	.
Ruptured blood vessel	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.
Tumour in throat -	.	4	1	.	.	1	.	.	1	2	.	.	1	7	1	.
Dropsy - - -	.	3	1	.	.	.	.	.	.	1	.	.	.	4	1	.
Pneumonia - - -	.	.	.	.	1	.	.	.	1	.	.	.	2	.	.	.
Diseased liver - -	.	6	1	1	3	3	.	.	.	3	.	.	3	12	1	1
Lockjaw - - -	.	.	.	.	2	.	.	.	3	.	.	.	5	.	.	.
Pleuro-pneumonia -	.	144	59	.	.	52	20	.	.	62	29	.	.	258	108	.
Black-leg - - -	.	.	7	11	.	.	.	7	.	.	.	4	.	.	7	22
Dysentery - - -	.	.	.	.	.	.	.	.	1	1	.	1	1	1	.	1

† The Table shows that horses are chiefly destroyed by indigestion. Contagious epizootics do not rage amongst them, and accordingly insurance offices always made large profits on horses; so large, indeed, that they were kept alive by them to a great extent. The loss on horses occurs invariably amongst the worst—the low-priced animals.

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* Official return by the Registrar-General for Ireland.

IV. Cattle diseases in relation to supply of meat and milk. By Mr. Gamgee.

Diseases by which Animals have died, &c.—*continued.*

Diseases.	1859.				1860.				1861.				Total of Three Years.			
	Horses.	Cows.	Feeders.	Calves.	Horses.	Cows.	Feeders.	Calves.	Horses.	Cows.	Feeders.	Calves.	Horses.	Cows.	Feeders.	Calves.
Weed	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.
Consumption	.	6	1	.	.	8	1	.	.	5	.	2	.	19	2	2
Unknown	.	3	3	.	3	.	.	.	2	.	.	.	5	3	3	.
Parturition	2	2	.	.	.	.	.	.	.	1	.	.	2	3	.	.
Staggers	1	6	.	.	3	5	15	.	1	.	.	.	5	11	15	.
Growth on tongue	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.
Rheumatic fever	.	1	.	.	.	.	.	.	.	1	.	.	.	2	.	.
Tubercular deposit	.	.	.	.	.	.	.	.	.	.	1	.	.	.	1	.
Disease of uterus	.	8	.	.	.	2	.	.	.	1	.	.	.	11	.	.
Garget	.	.	.	.	.	.	.	.	1	.	.	.	1	.	.	.
Hoven	.	1	.	.	.	3	1	2	.	.	.	.	.	4	1	2
Disease of brain	.	.	1	.	3	2	2	.	.	.	.	.	3	2	3	.
Diarrhœa, scurvy, and dysentery	.	2	3	1	1	.	1	1	.	.	.	.	1	2	4	2
Heart disease	7	.	.	.	3	1	.	.	.	.	.	.	10	1	1	.
Red water	.	2	.	.	.	1	.	.	.	.	.	.	.	3	.	.
Inflamed udder	.	2	.	.	.	1	.	.	.	.	.	.	.	3	.	.
Cancer in foot	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.	.
Tuberculosis	.	.	.	.	.	1	1	.	.	.	.	.	.	1	1	.
Debility	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.	.
Stoppage of water	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.	.
Diseased spleen	.	1	.	.	.	.	1	.	.	.	.	.	.	1	1	.
Ruptured gullet	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.	.
Chronic disease	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Bloody flux	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Dyspepsia	.	1	.	.	.	.	.	.	.	.	.	.	.	1	.	.
Totals	65	246	84	14	74	129	55	12	60	116	35	10	199	491	174	36

Mortality from anthrax in calves.

It is interesting to notice the extraordinary loss amongst the cows and feeding-stock by pleuro-pneumonia, whereas not one of the calves (bred on the farms and kept by themselves) included in the report died of the lung disease. But on the other hand how significant is the loss of 11 out of 14 by anthrax, 7 out of 12, and 4 out of 10 by the same disease, giving a total for the three years of 22 calves destroyed by anthrax out of 36 that died of disease. Let it not be said that the Milzbrand of the Germans is unknown in this country! It is the most fatal of all our enzootic disorders, and so far as Scotland is concerned commits great ravages in the counties of Mid-Lothian, Haddington, Forfar, Lanark, Stirling, Fife, Berwick, Banff, Renfrew, Perth, Aberdeen, Kincardine, Selkirk, and Peebles. Any one can see, however, with regard to cows and feeders, that the diseases most destructive next to pleuro-pneumonia are such that under judicious management could be quite avoided. I especially refer to the indigestion which killed 41 cows out of 233 that did not fall victims to pleuro-pneumonia, and again amongst the feeders no less than 8 out of 66 died from the same cause.

Parturition fever, entirely due to extravagant waste in overfeeding cows prior to parturition, carried off 43 of the 190 animals that had escaped the lung disease and indigestions.

Greatest losses amongst the best cattle.

Amongst cattle the loss occurs amongst the best, the highest priced ones. It is not, however, to be supposed that our improved breeds are more liable than the old ones to disease. It is true the Shetlander and the Highland ox are more hardy than the short-horn, but the health of the short-horn stocks generally contrasts most favourably with the health of ordinary hardy feeding stocks, and especially with the less pure and naturally sound constitutioned cows sold for the town dairies. The fact is, all stock, whatever may be its breed and qualities, is equally liable to pleuro-pneumonia. Young stock, which is the cheapest, is to a

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great extent in the breeder's hands and healthy, whereas three and four year old feeding cattle and dairy cows which have reached or are attaining their highest value are passing freely through the dealer's hands and die.

Very startling results are obtained by calculating the losses this country has sustained since the importation of cattle and of contagious diseases.

Estimated losses by disease amongst horned cattle in 1860.

The most recent statistics of mortality to be relied upon are those, already given, of Scotland, for the year 1860, which, on taking the average amongst stock of all kinds, amount to 4·89, or very nearly five per cent. If in 1860 the whole of the United Kingdom had (as I believe it at least to have had) the same rate of mortality as Scotland, in that year there died of disease, in Great Britain and Ireland, 374,048 horned cattle, having, at the average value of 10*l.* 3*s.* 6*d.* per head, a total money value of 3,805,939*l.* 8*s.*, and if the Mid-Lothian experience of the causes of death be applied to this matter, we may infer that more than half the loss was due to pleuro-pneumonia.

Losses in 1860 in relation to our importations.

The number of cattle imported in 1860 was 104,569, and their value (at 8*l.* per head) may be estimated at 836,552*l.* It will thus be seen that the number of cattle estimated to have died by disease was 3·57 times the number imported in the year, and that the estimated deaths from pleuro-pneumonia were more than 1·89 times the number of cattle imported. Taking the estimated values, we find that the entire deaths from disease represented 4·5 times the value of the cattle imported, and that the deaths from pleuro-pneumonia represented considerably above twice the value of these imports.

Estimated losses by disease amongst horned cattle in six years ending 1860.

As one year cannot be considered a sufficiently fair estimate, we may give the calculations for the six years ending 1860. The average annual loss of cattle during this period has been estimated at 4·915, or over the whole stock of the three kingdoms to be 375,850. The estimated total for six years amounted to 2,255,100. The value of animals lost amounted, at 11*l.* 10*s.* per head, to a grand total of 25,934,650*l.* Of this number there died from pleuro-pneumonia considerably above one million during the six years, and these represented a value of about twelve millions sterling.

Relation of losses to number of cattle imported during six years.

The number of cattle imported during the six years ending 1860 was 553,033. Their estimated value at 8*l.* per head, 4,424,264*l.* The loss by disease was four times the number of cattle imported, and by pleuro-pneumonia it exceeded twice that number. On estimating their values we find that the value of the cattle lost was 5·89 times the value of the importation, and more than half that loss due to pleuro-pneumonia.

Losses amongst sheep.

The sheep of the United Kingdom have been estimated * at about 40,000,000, and are worth at least as many pounds sterling. Their average mortality by disease is not less than 4 per cent. It attains 5 per cent. in Ireland, and exceeds this in Scotland. The money value represented by the deaths over the whole kingdom is therefore not less than 1,600,000*l.*

Losses amongst pigs.

There are, moreover, about 4,298,141 pigs, which may also be valued at 1*l.* a head, though usually considered as worth considerably more. In Ireland there is a loss at least of 10 per cent. on these animals. In Scotland the loss is small, and the mortality is not very great amongst them in England as compared with Ireland. I cannot however calculate it at less than 3 per cent. over the three kingdoms. This would give a loss in round numbers of 1,209,000*l.* sterling.

Total estimated annual losses.

Thus the deaths among stock in the United Kingdom probably represent an annual amount of more than six millions sterling. In

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* By Mr. Robert Herbert.

large towns the mortality of cows very greatly exceeds any proportion which I have stated. I shall directly adduce instances on the largest scale where it has amounted to more than 50 per cent. I subjoin a table prepared with great care since I have been engaged in this inquiry, giving a more correct statement than has ever been published, and one which rather understates than overstates the losses which have been sustained.

STATISTICAL TABLE, showing the Proportion of DISEASED COWS sold from 88 DAIRIES of EDINBURGH, during the Year commencing the 1st July 1861, and ending the 1st July 1862.

Dairies investigated.	No. of Cows ordinarily kept.	No. sold diseased to Butcher.	No. sold for Pigs.	Total sold diseased.	Dairies investigated.	No. of Cows ordinarily kept.	No. sold diseased to Butcher.	No. sold for Pigs.	Total sold diseased.
I.	12	3	2	5	XLV.	20	11	3	14
II.	55	22	2	24	XLVI.	12	3	1	4
III.	18	8	..	8	XLVII.	20	13	2	15
IV.	16	8	1	9	XLVIII.	25	14	6	20
V.	6	..	1	1	XLIX.	25	13	5	18
VI.	30	14	5	19	L.	16	8	4	12
VII.	12	2	..	2	LI.	18	5	3	8
VIII.	5	2	1	3	LII.	26	13	7	20
IX.	25	13	3	16	LIII.	30	16	2	18
X.	40	13	7	20	LIV.	10	4	4	8
XI.	20	4	3	7	LV.	24	9	7	16
XII.	28	12	1	13	LVI.	30	21	3	24
XIII.	25	4	5	9	LVII.	25	12	8	20
XIV.	16	5	2	7	LVIII.	12	2	4	6
XV.	10	3	..	3	LIX.	26	14	3	17
XVI.	18	5	2	7	LX.	14	14	1	15
XVII.	40	27	3	30	LXI.	22	9	3	12
XVIII.	8	3	1	4	LXII.	12	1	3	4
XIX.	6	2	..	2	LXIII.	6	2	2	4
XX.	40	16	2	18	LXIV.	10	1	1	2
XXI.	6	2	..	2	LXV.	50	19	12	31
XXII.	30	13	4	17	LXVI.	6	2	1	3
XXIII.	25	18	2	20	LXVII.	12	2	2	4
XXIV.	16	..	4	4	LXVIII.	22	10	3	12
XXV.	18	6	6	12	LXIX.	26	3	..	3
XXVI.	22	15	3	18	LXX.	20	10	4	14
XXVII.	12	5	..	5	LXXI.	18	14	3	17
XXVIII.	20	5	2	7	LXXII.	20	8	4	12
XXIX.	20	5	1	6	LXXIII.	20	13	3	16
XXX.	22	11	3	14	LXXIV.	24	8	6	14
XXXI.	16	7	2	9	LXXV.	20	8	2	10
XXXII.	25	13	4	17	LXXVI.	26	6	8	14
XXXIII.	12	8	2	10	LXXVII.	26	9	10	19
XXXIV.	25	15	7	22	LXXVIII.	30	11	3	14
XXXV.	10	1	1	2	LXXIX.	46	20	8	28
XXXVI.	12	6	1	7	LXXX.	24	7	2	9
XXXVII.	9	4	..	4	LXXXI.	12	6	4	10
XXXVIII.	22	13	3	16	LXXXII.	16	2	5	7
XXXIX.	25	18	4	22	LXXXIII.	40	17	9	26
XL.	16	8	2	10	LXXXIV.	25	7	..	7
XLI.	50	37	3	40	LXXXV.	40	13	13	26
XLII.	20	11	1	12	LXXXVI.	16	5	5	10
XLIII.	10	6	..	6	LXXXVII.	18	4	2	6
XLIV.	6	1	1	2	LXXXVIII.	20	8	6	14
44 Dairies -	879	394	96	489	44 Dairies -	960	397	188	586
					1st Column - -	879	394	96	489
					TOTALS - -	1,839	791	284	1,075

NOTE.—This Table includes the reports of 88 Edinburgh dairies ordinarily containing about 1,839 cows, out of which, in one year, 791 diseased cows were sold to butchers, and slaughtered for human food, and 284 were sold as food for pigs.

It will be seen that of the total number of cows kept in Edinburgh, 58½ per cent. were sold diseased, of which 43 per cent. were sold to butchers for human food, and 15½ per cent. as food for pigs.

The total value of the 1,075 diseased animals when first bought, at the very moderate average of 13*l*. 10*s*. each, is 14,512*l*. 10*s*. There was realized by their sale, calculating the value of the 791 sold to butchers at an average of 5*l*. each, and the 284 sold for pig feeding at 10*s*. each, the sum of 4,097*l*. The net annual loss for diseased cows in Edinburgh alone may therefore be estimated at 10,415*l*.

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When in Dublin lately, however, I was enabled to learn that such a loss is not confined to Edinburgh. Indeed, I know that the fine stock of the Edinburgh dairies is not placed in more unfavourable conditions than the cows of all other British towns. The Glasgow cows die off as rapidly and the London cows likewise. But in Dublin I was fortunate enough to obtain information as to the average losses for 20 years ending the 1st July 1862, viz., since the very first appearance of pleuro-pneumonia in the United Kingdom.

Average Loss for the 20 Years ending 1st July 1862.

Cases investigated.	Number of Cows kept.	Sold diseased yearly since 1842	Average Loss in Money in each Year.
			£
I.	100	40	250
II.	45	30	168
III.	34	23	130
IV.	20	10	100
V.	20	6	70
VI.	20	6	70
VII.	16	6	70
VIII.	40	30	200
IX.	20	10	100
9 Dairymen	315	161	£1,158

Thus it would appear that even in Dublin, where the cows are turned out during the greater part of the year, the mortality amounts to 51·11 per cent., and dairymen, in order not to be ruined, are of course compelled to sell water, diseased milk, and diseased cows.

I shall conclude by stating my belief that on the 12,000 cows kept in London and its suburbs there is an annual loss of at least 80,000*l.*; besides which a very large amount is lost in the many dairies which supply London from a distance.

It may be well to add that of the animals estimated as lost many have been sold as human food, so that all that may be regarded as salvage in a money point of view is diseased meat supplied to the people.

II. Nature of the Prevailing Cattle Diseases of the United Kingdom.

Epizootic Diseases.

Definition of an epizootic disease.

The difficulties of definition are not easily overcome in stating what we recognise as an epizootic disorder. It is a malady spreading far and wide over a country or countries. But not every malady which attacks a large number of animals in many districts and many counties is termed "epizootic." For among such diseases some are due to local influences, which being accidentally repeated in many different places give rise to the coincidence of simultaneous outbreaks of disease over a wide extent of country. And accordingly we distinguish these wide-spread plagues which are independent of local influence from the disorders which can be proved to depend on damp, exposure, malaria, improper feeding, and similar local causes.

The line of demarcation between these two classes of disease is very essential in the present study, and is perhaps more easily established in

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veterinary than in human medicine. It is to the first class only that the word *epizootic* is applied. The diseases included in it having originated in some definite region of the globe, spread in all directions without regard either to the breeds of animals, or to soil, climate, and other local influences. Such are the following :—The *typhoid* or *enteric fever* of cattle, which always spreads from the Russian steppes ; the *pleuro-pneumonia* of cattle, ever extending from central Europe, though probably traceable to Asia and Africa, in some parts of which it is a very common disease ; the *epizootic aphtha*, or *vesicular murrain*, which seems indigenous to Hungary and south-eastern Europe, to which it may first have passed from Asia ; the *sheep-pox*, or *variola ovina*, also imported from Asia and Africa, but constant in eastern Europe, and spreading westwards through central Europe.

Epizootics are contagious maladies.

All these maladies are contagious. They are mildest, as a rule, where they develop spontaneously, and are very destructive in their progress beyond such regions. They are most severe when they first break out in a fresh district, and many causes combine to diminish their fatality as they continue. Fresh accessions of virus by renewed importations, and the constant renovation of stock (in consequence of the short lives of our animals, and the rapidity with which they are bred), lead to local exacerbations, the frequency and severity of which are in proportion to the extent of imported disease, and the number of susceptible animals in the locality.

Course of epizootics in Europe.

Epizootic maladies travel in Europe from east to west, and exist more generally and constantly on continents than on islands. The British islands have been exceptional since the free introduction of foreign stock for our densely peopled cities. The smaller islands, such as Jersey and Guernsey, most renowned for their valuable cattle, are free from such diseases.

a. Pleuro-pneumonia in Cattle.

Synonymes.

This malady has been known in this country by the names of "new disease," the lung-plague, or lung-disease, of cattle. It is the Lungenseuche of the Germans, and Polmonea dei Bovini of the Italians.

Definition.

It is a contagious disease, characterized by inflammation of the lungs and pleura, peculiar to the ox tribe, and attacking all breeds of cattle without preference. It has been regarded by some observers as a malignant fever in which extensive inflammatory exudation in the lungs and pleural sacs ensues as a specific local manifestation.

Latent and apparent form.

The disease occurs in a latent form, as well as attended by severe symptoms of constitutional disturbance. It is found difficult to diagnose it in its earliest stage, when pulmonary lesions have already advanced considerably, as indeed is difficulty experienced in detecting latent cases.

Stage of incubation.

Like all other contagious disorders it has an incubative stage, which usually extends to between five and six weeks. In practice I have found it a safe rule to follow in giving opinions as to the probable time when cattle have been exposed to contagion, to calculate such time at about 40 days prior to the appearance of marked symptoms of the disease. Cows taken into infected dairies usually fall ill during the sixth week, a period noticed in consequence of the first period of sexual excitement after calving immediately preceding the attack. I have often noticed that cattle exposed to contagion in fairs have also shown signs of the lung-disease after the lapse of the same period of time.*

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* Instances are alleged of cattle not suffering till six months after their last known contact with diseased cattle, and my own observations lead me to infer that in all such cases there has been some later unobserved exposure to contagion, often by connexion with some animal which has had the disease in a mild and latent form.

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I have, moreover, to add that no outbreaks of pleuro-pneumonia can be well observed without the observers having great experience in auscultation, and by this means I have often detected convalescent animals that had not been supposed suffering from sickness, and others in the earliest stage of the disorder, when separation could prevent contamination of other susceptible animals.

Outbreaks of pleuro-pneumonia must be investigated by those who can auscultate.

Pleuro-pneumonia attacks an animal, as a rule, only once in its lifetime. It is owing to this that the practice of inoculation has been recommended as a preventive; and a very extensive dairyman in Glasgow brings up young stock which he infects by placing some cattle affected with pleuro-pneumonia amongst it, and then rears all that recover. This practice has been found to answer, but the experimenter requires to be extremely wealthy.

Pleuro-pneumonia only attacks an animal once as a rule.

Some animals have been attacked twice, but the second attack must rather be regarded as a relapse, inasmuch as it usually occurs within a very few weeks after the first one, and is due to exudation commencing in the lungs, at a distance from the part first implicated, and in which the progress of the disease had been limited by the formation of a cyst or capsule. The second attack occurs therefore in animals that have not completely recovered from a first one.

A relapse may occur.

In the present state of veterinary knowledge animals attacked by pleuro-pneumonia cannot be much helped by medical treatment. The records of such treatment are hitherto but records of failure to modify the severity of the disease. Nor would it be expedient for any farmer to submit his cases to treatment, unless he could thoroughly isolate them, from the still healthy portion of his herd,

Treatment.

b. Aphtha.

Various names have been applied to this disease. All over Scotland it is called the "murrain." On its first appearance in England it was named "the epidemic," and is very generally designated "the foot and mouth disease." Professor Simonds has called it eczema epizootica. It is the Maul und Klauenseuche of the Germans; la cocotte of the French, and febbre aftosa of the Italians.

Synonymes.

It is an aphthous eruption in the mouth, on the feet and teats of cattle, pigs, sheep, goats, horses, wild animals, and human beings. In Britain it has been chiefly observed in cattle, sheep, and pigs, and never was more prevalent than during the past year of 1862.

Definition.

The malady is characterized by a mild fever of an epizootic and decidedly contagious character. It attacks animals once in their lifetime usually, but the cases of repeated attacks in herds and flocks are not unfrequent. I have noticed several this year in dairies and amongst sheep.

Characteristic features.

The period of incubation is very short, and it is in consequence of this that the foot and mouth disease is said usually to precede pleuro-pneumonia in cattle. Cattle confined in markets suffer from epizootic aphtha on being taken to a farm, and having in the same markets come in contact with cattle suffering from pleuro-pneumonia show signs of this disease when its protracted incubative stage is at an end.

Short period of incubation.

Great losses are sustained by stock owners, when epizootic aphtha spreads, as the animals cannot eat, fall back rapidly in condition, and if lean die of inanition. Death often results in young animals from inflammation of the alimentary canal, and amongst cows there is great loss on their value owing to attacks of mammitis, interruption to the secretion of milk, &c.

Losses sustained from this disease amongst stock.

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Variola Ovina.—Small-pox in sheep.

Names of the disease.

The sheep-pox which has from time to time visited almost every part of Europe is known by many names in different languages. The older French authors describe its outbreaks under the head of rougeole, picotte, claveau, or clavelée. The latter name is the most generally known one in France. The Germans term the disease Shafpocken, Shafpockenseuche, and Schafblattern. In Italian it is called vajuolo pecorino.

Definition.

The disease is a specific, malignant, variolous fever, affecting the ovine tribe, spreading throughout Europe exclusively by contagion, affecting an animal only once during its lifetime, and characterized by a cutaneous vesicular eruption especially on those portions of the skin scantily covered with hair.

It is a fact worthy of notice that most of the warm-blooded animals are liable to a peculiar form of variolous fever, and that usually the disease is communicable from animals of one species to those of another. These variolous fevers vary much as to severity, and the most dangerous form known is that affecting the sheep. Fortunately the disease is not communicable to other animals as a rule, and if any are attacked the disease is in them of a mild and benignant character.

Natural sheep-pox.

Inoculated sheep-pox.

We distinguish amongst sheep the *natural* pox communicated from diseased to healthy animals in the ordinary spread of the disorder from the *inoculated* small-pox induced for the purpose of mitigating losses amongst flocks of sheep.

Course of the disease.

From the time that a healthy animal has been exposed to the influence of the small-pox contagion to the period of perfect restoration to health certain well-marked stages of the disease are observed. They are incubation, invasion, eruption, dessication, desquamation.

Stages.

Period of incubation and general symptoms.

The period of incubation is that during which the virus penetrates the system and lies apparently dormant. There are no signs of ill health. All animals passing through this period may be termed *infected* to distinguish them from healthy and from actually diseased sheep. The first symptoms of actual fever and eruption occur from a week to a fortnight after the virus has entered the system. The inoculated disease is usually more rapidly developed than the *natural pox*. Signs of invasion occur as early as the third day in some cases, though they have been observed as late as one and two months in exceptional cases. In hot weather and confined situations, where sheep are huddled together in stables or in small fields, the development of the malady is rapid and the period of incubation short. In cold weather and with all circumstances favouring a healthy state of the sheep the signs of invasion are greatly retarded, appearing usually under such circumstances from the twelfth to the fifteenth day, and as late as the twenty-fourth.

After this the skin acquires a flea-bitten appearance, inflammatory nodules or papulæ form on the skin, which are succeeded by vesicles; these dry, and scabs are formed, which are ultimately thrown off.

Duration and fatality.

Variola ovina extends in its attack over twenty days or a month. Death usually occurs on the fourth or fifth day of the eruption. As many as 80 or 90 per cent. of the affected animals sometimes die. Fifty per cent. is commonly witnessed, and unless a strict separation of diseased from healthy is resorted to every sheep in a flock is apt to take the disease.

Treatment.

Treatment is of slight importance in cases of sheep-pox in this country. Like all eruptive fevers it must be permitted to run through its various stages, and it is of great moment to protect the healthy from the diseased. My belief is that whenever cases of small-pox appear in any part of the British Isles the animals first seized should be destroyed at once.

The Steppe disease.—Russian cattle plague.—Contagious typhoid fever of cattle.—Typhus contagiosus boum.

Definition.

This terrible disease, so peculiar to the ox tribe that the Germans call it "*Rinderpest*," is a very contagious fever, characterized by specific lesions of the intestines similar to those of enteric fever in man. It originates invariably in Asia or the Russian steppes, and though confined to the bovine species it attacks cattle of all breeds with equal virulence. It spreads somewhat slowly, and is not very fatal where it originates as an enzootic, but it is propagated very rapidly and proves the most fatal of all cattle plagues when it crosses the Russian frontier into central Europe.

Symptoms.

The period of incubation extends usually to about one week. It may be as short as 24 hours, and sometimes, but rarely, as long as twelve or fourteen days. The appearance of this disease in a country is soon ascertained from the rapidity with which it destroys cattle and they are frequently found dead by the road-side.

From signs of dulness and discomfort there is a prompt transition to a state of high fever associated with catarrhal symptoms, abdominal pains, and nervous twitchings. Emphysematous swellings are apt to come in different parts of the body and diarrhœa hastens the reduction of the vital powers and dissolution.

Post-mortem appearances.

After death the mucous membranes are found congested and inflamed, especially in the alimentary canal. Peyer's glands soon assume the appearances described as occurring in human enteric fever, but there is less tendency to ulceration and perforation of the intestine. There is a yellowish deposit on the surface and in the substance of the mucous membrane. In the last stage of the disorder masses of the exudation are seen detached and loose in the intestinal tube.

Nature of the disease.—The post-mortem appearances just described correspond most remarkably with those of typhoid or enteric fever of man. I long since noticed this from reading carefully the best descriptions published of this disease, and suggested that instead of calling it contagious typhus, it should be called contagious typhoid or enteric fever. Some of the older authors regarded the malady as an impaction of the third stomach, and, hence called it "löserdürre," but the distension of the omasum with solid food is usually seen in all diseases of ruminants, and not always in the cattle plague.

Different observers have given a very different account of the nature of this disease, as indicated by the many names applied to it, such as Magenseuche, Gallenseuche, Uebergalle, Grosgalle, bösartiges Ruehrfieber, and so on. The disease is certainly not a form of typhus, and so far as I can learn, the only real difference between it and the enteric fever of man is the implication of the mucous membranes generally and the contagious character of the disease.

2. *Enzootic Diseases.*

Prevalence of enzootic disorders.

The very important and extensive class of diseases, the leading character of which is a dependence on peculiarities of soil, climate, and system of culture, has never attracted the attention it merits. However desirous I may be to enter fully on the consideration of these disorders in the present report, it is impossible to do justice to them.

They destroy our cattle to the extent of $1\frac{1}{2}$ or 2 per cent. over the United Kingdom; our sheep up to 5, 10, and 15 per cent., and swine to no less an amount, especially in Ireland. They are very rarely, if ever, contagious; they impoverish many districts best suited for the breeding and rearing of stock, and especially of sheep; they seriously interfere with agricultural progress and prosperity; they are all preventable, and would richly repay careful investigation and the adoption of measures for their eradication.

Domestic animals born sound.

Our domestic animals are born healthy, with sound constitutions, and the term of their lives is short. Taking an average amongst cattle, sheep, and swine, the age they attain does not reach four years. A knowledge of the management of such stock under the manycircumstances that induce the local diseases which destroy it would preserve it in vigorous health until ready for slaughter. It enjoys fresh air, is well fed, sheltered, and carefully watched. Every farmer knows that it is to his interest to protect his stock, and as a rule the many causes which induce human diseases in early life are not in operation as affecting the lower animals. There are few congenital defects, very few instances of morbid hereditary predispositions; born healthy and sound, very few should die a natural death. Accidents must occasionally happen, but there are favoured situations free from enzootic disorders where the losses amount to an extremely small per-centage, as a rule perhaps not attaining $\frac{1}{4}$ or $\frac{1}{2}$ per cent.

As matters have stood hitherto no inducement has been offered for the study and prevention of these diseases. If we refer, for example, to the enzootic diseases of sheep, we find that veterinary surgeons have very rarely been consulted regarding them; shepherds have been trusted to; the excessive mortality of one year has been set against the low rate of loss of another, and landowners or their agents have had to calculate that in consequence of a particular disorder prevailing on farms, the rental must be reduced so as to enable the farmer to meet his losses. Thousands of acres of land in different parts of the United Kingdom would be worth much more than they are if enzootic disorders were prevented. I believe that attention to this subject would for many years to come add more to the resources of the United Kingdom than the reclamation of land does. By all means extend the available amount of country for the production of food, but let us not forget to secure the full benefit of what can be derived from the land on which our stock has been fed for ages, and which is deteriorated largely in value by noxious properties that only require to be known in order to counteract them.

Enzootic disorders vary according to the geological characters of districts and counties. Altitude exerts a manifest influence on these diseases. The character of indigenous vegetation on mountains, hills, and low lands materially influences the production of diseases in animals.

Enzootic disorders are due to excessive richness and to excessive poverty of land. They are also due to excessive moisture, or on high and dry lands to exposure. They vary with different systems of culture; they are engendered by forcing land to produce the largest and best crops, or by impoverishing the soil in attempting to rear more than it will bear.

Enzootic disorders are induced by the manner in which animals of different species are brought together and made to live in common.

There are, therefore, enzootic disorders due to *natural*, and others due to *artificial* causes. Human intelligence has suggested how to correct *natural defects of land* for the purpose of rearing crops, and it can suggest means to correct them with a view to protect stock from

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disease. The *artificial causes* are, however, counteracted more readily, and with much greater certainty.

Of the enzootic disorders, I shall only notice the most important, which may be included under the two heads of anthracic and anthracoid diseases.

Anthrax or carbuncular fever; Milzbrand, Blutseuche (German); miltvuur (Dutch); maladies charbonneuses (French); typhus, pustula maligna.

There are many forms of anthrax fever. They all originate spontaneously in herbivorous and omnivorous quadrupeds; they are communicated by contact or inoculation to all warm-blooded animals when they occur under circumstances favourable to the development of the anthrax poison; they have raged as plagues in past centuries, and are apt to assume the epizootic character in hotter countries than our own; they rarely, if ever, spread by contagion in the United Kingdom, whereas continental observers attribute general outbreaks of these diseases chiefly to contagion.

Anthrax is a blood disease, a fever in which there is a very sudden change in the physical characters and physiological properties of the blood, and in which passive hæmorrhages, ecchymoses, phlegmons, boils and carbuncles, and gangrenous complications occur with fatal effect. It originates spontaneously in young animals more readily than in old, in the thriving and vigorous more readily than in the weakly; in those that are suddenly changed from spare to liberal keep, and on rich lands that are usually damp and ill drained.

The diseases which I shall now more particularly refer to under this head are all regarded as forms of anthrax in different parts of the continent, or as usually associated with the development of a poisonous principle that cannot be distinguished from the anthracoid virus. The best writers on carbuncular diseases have classified the different forms under three heads.

I. Carbuncular fevers without local complications. This includes the anthrax fever of solipedes and the "blood striking," "blutstaupe," of cattle and sheep. The latter disease is not regarded by Delafond as a form of anthrax, but it is by all other continental authors. It is also called "sang de rate" or splenic apoplexy. Braxy in sheep.

II. Carbuncular fevers with erysipelatous complications. The black leg or quarter-ill of Britain, known to the Germans under the names Milzbrand Emphysem des Rindviehs, fliegendes Feuër, &c.; black spaid in sheep; carbuncular erysipelas and carbuncular angina of the pig, are the principal erysipelatous forms.

III. Forms of anthrax with the development of boils and carbuncles. This includes the malignant carbuncles occurring in all parts of the body of animals and human beings. The pestis anticardia of Sauvages, so destructive amongst horses. Glossanthrax in cattle and sheep. Stomanthrax hordeolum of the pig, and another singular form in the same animal, termed Kopfanthrax and Kropfbrandbeule by the Germans, *soie* or *pique* by the French, and *setola* by the Italians.

Anthracoid diseases are those to which Hensinger has especially referred, as allied to well-defined form of anthrax. They have many points in common with the true carbuncular fevers, and in the absence of any very broad distinction they are grouped together under this head. They are parturition fevers of cows and ewes, the recently observed blood disorder of new-born lambs, and the red water of sheep or sanguineous ascites.

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Definitions.

b. Splenic apoplexy in horned cattle and sheep.

This is one of the many disorders dependent on high feeding which we experience some difficulty in defining. Many have no hesitation in considering it a form of anthrax fever, whereas others, such as Delafond, regard it as a simple hæmorrhagic attack implicating the spleen in very plethoric animals.

The name usually applied to the disease indicates that there is a transudation of blood in the substance of the spleen, and this organ frequently attains a very great size and weight from the mass of blood effused into it.

In splenic apoplexy there are no premonitory signs; the animals apparently enjoying the best health early in the morning, may be dead some time before noon. Occasionally there are symptoms of excitement, the eyes are prominent and the visible mucous membranes injected. Uneasiness suddenly manifests itself, and colicky pains indicate abdominal disorder. The urine voided is high coloured and red, and there may also be blood in the fæces. The back becomes arched, and the animal fixes itself, hanging on to anything by which it may be tied in a stall, or pressing back into a corner. The pulse is quick and hard, then feeble and small, and the breathing is accelerated and short. The animal soon drops, and is seized with convulsive twitchings. In addition to the discharge of fæces and urine tinged with blood, there is a red frothy liquid which escapes from the nostrils; the animal bellows, moans, and soon dies.

The duration of the disease varies from 4 to 24 hours. If the animals have been bled very early, they are not cured, nor can the disease be prevented by bleeding, but life may be prolonged. It would appear that an animal seized with splenic apoplexy, dies quicker if left quiet, than if excited by a drive or a journey per train; and I have never known an animal die in a railway truck, though it may have been moved from the farm when seized and detained for several hours on the journey.

c. Braxy in Sheep.

This, the most fatal disease of sheep in Scotland, is in various parts of Europe the most virulent form of anthrax. Many diseases are included under the general head braxy; but it is most commonly applied to a blood disease in which there is an unnatural tendency to coagulation within the blood vessels and consequent arrest of the circulation; the functions of the most important organs are suddenly interfered with, and the textures die, as indicated by the rapid decomposition which sets in with great activity before the animal has breathed its last.

Braxy kills upwards of 50 per cent. of the sheep that annually die of disease in Scotland, and is so fatal over extensive tracts of country, that it probably deteriorates the value of more land in Scotland than any other cause.

The victims of braxy are usually found dead by the shepherd on cold, frosty mornings, or after clear moonlight nights. If any animals are seen during the attack of the disease, they are found to have a peculiar look, staggering gait, bloodshot eyes, rapid breathing, full and frequent pulse, scanty secretions, and great heat of the mouth, limbs, and body generally.

After death, in addition to the swelling due to rapid putrefaction, there are the signs of a full state of the vessels of the body. Extravasations of blood occasionally occur, especially in the intestines, and these have been mistaken by many as the lesions of inflammation.

Braxy is essentially an incurable disease.

d. Black Quarter in Cattle and Sheep.—Anthrax of the Extremities. —Erisipelas Carbunculosum.

Occurs over a wide extent of country.

This form of anthrax occurs over a very wide extent of country in the three kingdoms amongst yearling cattle. It is not confined to cattle, as the Scotch shepherds are, in many districts, such as in the counties of Roxburgh, Berwick, Selkirk, and Peebles, acquainted with "black spald" of one-year-old sheep or hoggets. In the midland counties it is called "blackleg," and also affects young sheep.

Mr. Youatt has described this malady as inflammatory fever, but refers to other names by which the disorder is known in different parts of the country, viz., *quarter evil*, *joint murrain*, *hasty*, &c. The Germans have called it Milzbrand emphysem, Rauschender Brand, fliegendes Feuer, Viertheil, &c.

Next to pleuro-pneumonia it is the most destructive disease in this country.

It is rare to see black quarter in animals above two or three years of age. It may occur in older animals, as cases have been seen by myself and others in cows of eight or nine years of age. I need not add to the general history of causes of this form of anthrax, as they are those common to all forms. It prevails principally on undrained, retentive soils, and next to pleuro-pneumonia is the most fatal of all cattle disorders in this country.

Symptoms.

Symptoms.—The best animal of a lot of yearlings is seen to move about with difficulty, to indicate lameness on one of its limbs, either fore or hind, and at the same time the pulse rises to 80, 90, or 100, is full and strong, the breathing quick, expression of countenance indicating much disturbance, and the prostration great. The protruded head, bloodshot eyes, hot mouth, low moan, total loss of appetite, and intense thirst, are very characteristic. The loins and back are tender, and there is a painful swelling, commencing either at a fetlock, knee, or hock joint, or as high up as the stifle, elbow, or shoulder. The animal staggers and drops helpless to the ground at an early stage of the disease. There are symptoms of emphysema of the sub-cutaneous areolar tissue, and the crackling or pressure over the affected limb and trunk is a very significant symptom.

The animal is very costive in the early stage. The fæces afterwards become softer, and streaked with blood. The urine, at first high coloured, afterwards becomes tinged deeply with the blood colouring matter.

The skin sloughs over the swelling, and especially where it has been unduly pressed upon. An ichorous sanious discharge flows from the wounds thus resulting, and foul ulcers remain. Smaller ulcers occur in protracted cases on the mucous membranes, especially of the tongue and cheeks.

The increasing emphysema, coldness of extremities, and surface of body generally, small pulse and stupor, continue for a day or a little more, and the animal dies.

Post-mortem appearances.

Post-mortem appearances.—A general emphysematous state of the animal, great distension of the abdomen, slight cadaveric rigidity, and a discharge of bloody froth from the nose and mouth, are characteristic of the body of a yearling that has died of this disease. On removing the skin it is seen that the cutaneous vessels are turgid with blood, and over the quarter affected or over the loins, as well as over a shoulder or thigh, the sub-cutaneous areolar tissue is found infiltrated with dark-coloured blood and emphysematous. On making an incision into the tissues, it

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is found that they are matted together by a black coloured exudation, and in a state of gangrene. Blood that does not present any disposition to coagulate is found between the muscles, usually, in protracted cases, between the long muscles of the back. The serous membranes are covered with ecchymoses. The lungs are usually congested, and according to the side on which the body has been lying do we find right or left lung much distended with blood, and the bronchial tubes filled with a bloody froth. The pericardium is studded with ecchymoses, and the turgid but flabby heart is full of black semi-fluid blood in both auricles and ventricles. On washing the heart it is found that there has been free transudation of blood beneath the endocardium, especially over the fleshy pillars. The valves are also discoloured, and the aorta is stained with blood.

The same sanguineous infiltration is apt to occur in other parts of the body, such as in the liver, kidneys, beneath the mucous membrane of the alimentary canal, and within the cranial cavity.

Three-quarters of an animal dying of anthrax often appear sound.

It is important to notice that in very rapid cases, or when animals are slaughtered in the early stage of the disease, it is only one of the fore or hind quarters which indicates the disease of which the animal has died. The other three quarters may and have often been sold as sound meat. Recently I was consulted as to the disease in a number of yearlings, and though these animals were not very fat, the only traces I could get of those that had died previous to my visit were the fore limb of one and the hind quarter of another. These had been buried and were exhumed for my inspection, but the remaining part of the bodies had been sold to a butcher.

e. Glossanthrax or Blain.

This disease, as described by Youatt in his work on cattle, and observed by many veterinarians in former years, does not prevail to any extent now-a-days. It is a form of anthrax, characterized by the development of malignant carbuncle in the mouth, and especially on the tongue. It is the Zungenkrebs of old German authors, and the Zungen Karbunkel of others. The disease has been seen by Morel in France amongst sheep, though it is a form of anthrax almost entirely confined to cattle; and when the virulent poison developed in the course of the disease enters the system of other animals it produces a putrid fever, diarrhœa, &c., and not necessarily the carbuncle in the tongue.

Symptoms.

Glossanthrax appears without premonitory signs. Rychner says that cases may be looked for in districts where anthrax prevails when the foot and mouth disease is raging. White pustules occur on the tongue, cheeks, lips, palate, or near the frænum linguæ. The pustules vary in size from a bean to a hen's egg ; usually there is one large pustule. Whether there be one or more, their malignant character is discovered by observing a rapid change in their colour from white to red and purplish black. There is much constitutional disburbance, and as the disease advances there are the signs of stupor, languor, &c., peculiar to putrid fever or blood diseases. Sometimes slight fever precedes the local eruption, but usually succeeds it. In about 12 or 14 hours the affected part begins to slough off, and the whole tongue sometimes drops piecemeal out of the mouth. Death occurs in from 24 to 30 hours.

The post-mortem lesions are similar to those of black-quarter, with the exception of the local appearances in the mouth. The ecchymoses, &c. occur in different parts of the body.

Spreads occasionally as an epizootic.

Hering says that glossanthrax is the most constant of the forms of anthrax, spreading occasionally as an epizootic and attacking many cattle owing to its virulent contagious character. Gellé says that the disease is purely local until the pustule bursts. The absorption of virus which then occurs speedily affects the whole system.

Case of glossanthrax.

The most recent case of glossanthrax reported was published in the *Edinburgh Veterinary Review* for December 1862.

It must not be supposed, however, that glossanthrax does not occur much more frequently than would be indicated by the smallness of the number of cases recently recorded. I have no doubt that the disease is rather common in some parts of Ireland, but there are no veterinary surgeons to report on it. A few years ago a large number of cases were seen in Aberdeenshire.

f. Anthrax in the Pig—Apoplexy—The Hog Cholera.

Swine badly affected with carbuncular diseases when they prevail.

Wherever carbuncular diseases prevail, swine are badly affected with them. It is not easy to define what blood disorders are to be regarded as forms of anthrax in these animals and which are not. I must, however, notice the *curbuncular angina*, the *stomanthrax hordeolum*, the *neck anthrax* or soie of the French, *carbuncular apoplexy*, and, lastly, the *blue sickness* or *hog cholera*. The two last named forms are very prevalent in the United Kingdom, and interfere with the production of sound pork.

Carbuncular angina.

1. *Carbuncular angina.*—This disease is ushered in by symptoms of general disturbance, such as loss of appetite, vomiting, constipation, &c. A very painful inflammatory swelling occurs then around the pharynx and larynx. There is difficulty of breathing, panting, and great heat of the expired air. Signs of apnœa supervene, such as blueness of the visible mucous membranes and of the skin, protrusion of the swollen tongue, interference with the function of deglutition and a painful cough. There is a hard, hot, and painful swelling extending downwards in the course of the windpipe, and extending beneath the chest. Sloughing of the mucous membrane around the fauces occurs, and the symptoms of a typhus fever develope. The animals die in from one to three days.

Pigs that have eaten of the flesh of animals that have died of anthrax seized with the disease.

Hering says that without doubt pigs are seized with this affection when they have eaten the flesh of animals that have died of anthrax. I can confirm this from the frequent attacks to be observed amongst flesh-fed pigs. I am informed that eight pigs died presenting symptoms such as the above in Fife. They were fed entirely on diseased cattle and horses.

2. *Stomanthrax Hordeolum—Rankhorn der Schweine, &c.*—This form of anthrax is very similar to the glossanthrax of cattle and sheep. It commences with loss of appetite, uneasiness, trembling, anxious and staring look, hot mouth, and increased secretion of saliva. Marked symptoms of fever are developed rapidly, and early during the attack an eruption occurs on the buccal membrane. In different parts of the mouth vesicles form, which are rarely numerous; sometimes there is but one about the size of a bean. There is considerable inflammation around the seat of the vesicles, which are themselves at first white, and some of a brownish or blackish colour. They burst, and sloughing of the tissues beneath occurs rapidly. There is a tendency to fetid diarrhœa, discharge of blood with the excrement and urine, and there is great prostration of the vital powers. The animals die in from 24 to 48 hours from the commencement of the disease.

The neck anthrax.

3. *The neck anthrax—Kropfbrandbeule of the Germans—Soie or pigue of the French—Setola of the Italians.*—This form of anthrax is not as common as the foregoing varieties. In this country it is very rare. Heusinger says that it is common in Poland, Hungary, and southern Europe.

The early symptoms are similar to those of other forms of anthrax, and the features which characterize it are due to an eruption over the parotid region or on the upper part of the neck. Small boils form, on which the bristles are erect, hence the names applied to the disease by continental authors, such as soyon, maladie piquante, poil piqué, setolone, &c. The bristles are stiff and dry ; the pig experiences great pain if they are pulled, and around the base of each hair there is a depression. The skin is discoloured and usually of a purplish tint. The intense thirst, loss of appetite, grinding of teeth, and dulness perceived at the early stage are but the premonitory signs of a severe fever ; total inactivity or a state of stupor supervenes. The mouth becomes intensely hot and clammy ; there is occasionally a free discharge of saliva ; deglutition is interfered with, and the breathing is oppressed. Diarrhœa sets in, the affected parts occasionally slough, erysipelas spreads from the neck downwards, and the animal usually dies on the third day of the attack. It may live on to the seventh, eighth, or ninth day. The cadaveric lesions are similar to those of other forms of anthrax.

Apoplexy in pigs.

4. *Apoplexy in Pigs.*—This disease often occurs under circumstances when it is quite easy to determine that the malady is not of the nature of anthrax, but there are differences of opinion as to other forms.

Thus I was called the year before last to look at a number of pigs kept by a miller in the suburbs of Edinburgh. Three had died very suddenly and in rapid succession. Others were ill, and some still healthy.

The pigs had been fed for a day or two on much richer food than they had had previously. They were accustomed to get the mill sweepings, with some bran and kitchen refuse, but the mill sweepings happened to contain a large amount of solid grain when last got in, and the pigs, which were in beautiful condition, died. They suddenly left off eating, appeared restless, had peculiarly prominent bloodshot eyes, foamed at the mouth, and fell over dead. We stopped the food, administered emetics, and the disease stopped.

To this form of disease we must attribute the cases published in the *Medical Times and Gazette* for the 29th of November.

Names given to the disease.

5. *The Hog Cholera.*—Many names have been applied to this disease. It is known in Ireland as the " blue disease," " blue sickness," " distemper in pigs," " red soldier," and the " hog cholera." The latter names have been also employed for it in America. Continental authors have theorized on the nature of the disease, and named it in accordance with their respective opinions, *typhus*, *erysipelas carbunculosum*, *gastro enteritis*, *anthrax*, *&c.*

Nature of the malady.

It is a malady which first affects the digestive organs, and then the blood undergoes changes favourable to transudations, which occur in different parts of the body. The best and most recent memoir on the subject has been published in the Magazin für die gesammte Thierheilkunde for this year, by Mr. C. Schmidt, veterinary surgeon in Jesberg-Kurhessen. Schmidt does not look upon the disease as anthrax. He agrees with Falke and others in regarding it as *typhus*. On this subject there are differences of opinion.

Schmidt on the disease.

Symptoms.

Symptoms.—The death of one or more pigs under mysterious circumstances directs the attention of persons to the health of the stock, and though the premonitory signs occur rarely and late, some pigs are noticed to be dull, not to seek for food or water, to creep beneath the straw, or in any dark place, and their head is held low and ears are drooping. Signs of abdominal pain are often well marked, and as a rule there is a disposition to lie on the belly. In some instances there is much cerebral irritation, and in others stupor. The animals are either wild, frantic, or quite

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unconscious. The retching is occasionally violent, and food may be vomited, or mucus and bile.

In the early stage the fæces are of normal consistence, and urine pale. Slight diarrhœa sets in, and the excrement is then dark and fetid. The pulse rises to 100 or 120 per minute, and the heart-beats are barely perceptible. The staring look, tendency to press on the abdominal organs, rolling about, inability to stand, &c., are indicative of increasing pain. There is a singular jerking or spasmodic breathing in all the cases complicated by congestion of the lungs. There is marked weakness of the hind quarters from the commencement of the attack. The animal staggers, its limbs cross each other, and at last are paralysed and cannot move. It is then found that the animal cannot scream, and there is a subdued hacking cough. The blood does not flow if a vein is opened, and ecchymoses occur over the whole body. The discoloration of the skin and mucous membranes which has suggested so many names for the disorder, commences some time before death, and occurs especially on the belly, on the inner surface of the hind extremities, on the back, ears, &c. The redness or purplish colour disappears wherever the skin is pressed, except in parts where any extravasation of blood has occurred. An eruption is apt to appear, and the cuticle desquamates. There are no signs of erysipelas. Schmidt says that on many animals the red colour is wanting, and does not occur even after death. In the rapid cases the mucous membranes are of a bluish red colour, and in the chronic cases of a dirty yellow. The temperature of the body is at first increased but afterwards lowered. Schmidt has seen blood oozing through the skin in two cases. In both it appeared as a critical sign, and the animals recovered after it.

Death occurs in from three to six hours from the commencement of this disease. Animals that recover, unless well treated, continue to suffer from paraplegia or from rheumatic inflammation of the joints.

Post-mortem appearances.

Post-mortem appearances.—The skin is black and blue, as if the animal had been knocked about during life, and ham and bacon dealers pass such blotches off for bruises. The capillaries and moderately sized veins of the skin and subcutaneous tissue are dark coloured, and gorged with blood. A yellow serum is apt to accumulate wherever there is this ramified redness. The serous and mucous membranes are studded with ecchymoses, which are most developed as a rule in the thoracic organs. Impaction of solid material in the intestine is frequently observed. The liver and spleen are congested, of a dark colour, and the parenchyma of the liver more particularly is soft. The lungs may be much congested. The blood is dark, seems fluid, and coagulates very slowly and imperfectly.

g. Parturition Fever in Cows.

Synonymes.

This very fatal disease is usually designated "dropping after calving," or milk fever, and from the frequent occurrence of effusion of blood in the cranium and spinal canal, Professor Simonds has termed it "parturient apoplexy." It is the Kalbefieber of the Germans, and fiévre vitulaire of the French,—a blood disease, characterized by a tendency to cerebral congestion and apoplexy, occurring in highly plethoric cows immediately after parturition. Various forms of parturition fever have been described, but the very prevalent malady amongst high fed cows observed in all parts of the United Kingdom is certainly but one of the results of plethora, and not, as some observers have supposed, a contagious adynamic fever.

Definition.

It is a very destructive malady, which, though amenable to treatment, has a great tendency to recur in all animals affected, and the attacks are the more severe at each recurrence.

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The animals affected give birth to their young with great facility, appear afterwards in perfect health, but drop suddenly and are unable to rise. Death results from *general paralysis*, and often in the course of a very few hours from the first manifestation of ill health.

The disease is treated by means of blood-letting in the earliest stage, purgatives and derivatives afterwards, and is fortunately amongst the maladies most readily prevented.

h. Heaving Pains in Ewes.

Synonymes.

This, the "parturition fever" of ovine animals, is known in many parts of England by the name "after-pains." It is a malady peculiar to British stock, and concerning which the best continental authors are silent.

Definition.

"Heaving" in ewes consists in violent straining as in labour, which comes on about the second or third day after yeaning, and depends on a condition of the blood favourable to stasis; congestion and mortification of the womb occur, and the animals die in a very few hours.

The painful discharge, high-coloured urine, swelling of the genital organs, violent spasms, and severe irritative fever, are characteristic of the disorder.

It is a malady which affords greater scope for the adoption of preventive than curative measures.

i. Blood Disease in Lambs.

Synonymes.

I first described this affection under the head "New malady in lambs." It has been known to sheep-owners and shepherds by the name "navel-ill," though of late years the "navel-ill" has been characterized by extraordinary complications due, according to post-mortem appearances, to inflammation and suppuration in the liver.

Definition.

This is another of the very numerous results of plethora, in which there is a very sudden change from perfect health to fatal disease, due to stagnation of blood, coagulation of that fluid in the blood vessels, and consequent death.

Complications.

The disease is not, as some have supposed, a contagious fever, but it destroys a very large number of lambs varying from two days to a week old. I have seen it associated on high and exposed lands with rheumatic arthritis, a disease very generally known by the name of "joint-ill in lambs." The dulness and prostration of the affected animals, the thickened umbilicus and intense fever, with a weakening diarrhœa in the latter stages, indicate the presence of the malady, which usually kills its victims in about 24 hours.

Swellings of an anthracoid character frequently appear about the throat, lips, ears, limbs, &c.

This is again one of the incurable disorders the prevention of which is easy and certain.

j. Red Water in Sheep.

Synonymes.

This enzootic disease, which I find to prevail in many parts of Ireland, has but rarely been the subject of observation on the part of veterinary surgeons in the United Kingdom. In 1849 Mr. Gowing described the malady in an article entitled "A fatal disease in sheep."* Mr. Simmonds afterwards suggested the name "sanguineous ascites." It is the "pourriture aigue," maladie rouge, or maladie de sologne, of French authors. Delafond has applied the name of "diarrhaemia" to the disorder and the German veterinarians are silent on the subject.

Definition.

This is another result of the plethoric state attacking lambs shortly after their birth, or older sheep. It is a blood disease characterized by

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* Veterinary Record, vol. v. p. 363.

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an effusion of reddish coloured serum in the abdomen, and the affected animals are usually found dead by the shepherds, and as they call them "water-bellied."

3. PARASITIC DISEASES.

The subject of parasitism has within the last twenty years afforded scope for the most interesting researches, and is one which should constitute matter for prolonged discussion in a report such as the present.

Opinions formerly entertained as to the origin and fatality of parasitic disorders.

In former times there was a tendency amongst medical observers to attribute many of the most fatal and most common diseases of man to the influence of animal or vegetable parasites which were often supposed to generate spontaneously under stated circumstances. As Leuckart says, "da war kein scheweres und gefährliches Leiden, das "die Parasiten und insonderheit die Eingeweidewürmer nicht zu "erregen im stande sein sollten." * A reaction occurred amongst pathologists, and as many products supposed to be parasitic proved to be nothing of the sort, it was supposed that entozoa existed in the bodies of men and animals for some wise purpose and excited the secretions, favoured digestion, &c. Amongst veterinarians Bracy Clark advocated such views early in the present century, and went so far as to recommend horsemen to give their horses some of the germs of oestrus equi that their stomachs might not be deprived of the healthy stimulus which they enjoy in a state of nature from the usual system of propagation of these parasites. Bracy Clark thus advocated doctrines which had been defended by no less eminent naturalists before, such as Götze and Abeldgaard.

It was supposed by others that parasites developed in animals previously diseased, and that a predisposition had to be acquired by a certain state of ill health for the production of any parasitic malady.

Parasites are offensive products derived from pre-existing parents.

We now know that parasites are not generated in certain morbid conditions, and do not exist in animals to excite the normal functions of those organs. They are offensive products foreign to the bodies of the men and animals they afflict, and dependent entirely for their development on the introduction of germs into bodies suited to their growth, protection, and reproduction.

A few parasites exist in or on all human beings and animals, but certain parasitic animals and vegetables induce actual disease and often diseases of a very fatal nature.

Parasites injure from mechanical interference.

The manner in which entozoa injure and destroy is not always the same. Some induce disease and irreparable structural changes in important organs from their mere growth and multiplication in those organs. Thus the brain of the ox or sheep is destroyed by coenuri and echinococchi. The cattle parasites and flukes lead to destruction of the lives especially in the sheep, and tens of thousands of these animals are annually destroyed by the last-named parasites.

A variety of diseases are induced according to the manner in which the parasites lodge in an organ or according to the peculiarities of the organ itself. Thus echinococchi not unfrequently induce cardiac tumours in the lower animals attended by all the symptoms of chronic heart disease, and ending in sudden death. Parasites in the cranial cavity lead to paralysis, wasting of the body, and many complications ending also in death.

Tubular organs are obstructed by parasitic accumulations. Thousands of the calves, sheep, fowls, pheasants, &c., are annually suffocated by round worms in their wind pipes. Obstructions of the alimentary canal occur in young animals from the accumulation of ascarides.

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* Die Menschlichen Parasiten und die von ihnen Herrührenden Krankheiten von Dr. Rudolf Leukart, Leipzig, 1862.

I have said that parasites induce ill effects from the manner in which they lodge in an organ. The trichinæ affords us an excellent example, in penetrating the sarcolemma, and taking the place of the active muscular elements.

Parasites rarely impoverish the blood directly, but may do so.

Leuckart has spoken of the usually accepted view that parasites injure by impoverishing the blood of their victims. He has made an interesting calculation on the subject. He says, a tapeworm (botriocephalus latus) of 7 metres in length, weights about 27·5 grains. It may during its growth, lasting as it does from 5 to 6 months, require from four to six times its weight in nutritive material, but that is of no importance to a man. Greater losses are sustained by children when large numbers of ascarides accumulate in the intestine. The only instance of a parasite killing by draining the blood of man is the blood-sucking anchylostoma duodenale (strongylus quadridentatus), which attaches itself to the mucous membrane of the intestine of the Egyptians and other oriental people, and in such numbers that on opening the intestine it appears covered with leeches.

So far as my own inquiries extend as to parasites in the lower animals none kill by merely draining the system of blood. I shall refer elsewhere to this supposed action of distoma haepaticum.

Movements of parasites injurious.

Parasites are living and moving bodies, and in their perigrinations through the system or in their movements in a part in which they are lodged they induce great derangement, and may kill. I have witnessed this in my experiments with coenuri and when many germs are introduced into the system of pigs and calves, &c. for the development of hydatid disease, deaths are frequent when the embryos bore through the tissues. In the pig death occurs from the piercing of the intestine by echynorhyncus gigas, &c.

Leuckart refers particularly to the injurious effects of the movements of parasites. They induce an irritation which is followed by congestion and inflammation varying in intensity according to the number of parasites, and the rapidity of their movements. He adds that "the " most striking example of the truth of these statements is afforded by " the trichinæ, which on their passage into the intestinal canal induce " a malignant enteritis with the production of false membranes, and " lead to appearances which have a great resemblance to those of " typhus. This happens, at all events, when the number of imported " parasities is great, amounting, perhaps, to upwards of 100,000, as " is not rarely found after the eating of trichinous meat. I have seen " a corpse in which half an ounce of flesh contained about 300,000 " trichinæ. In other cases the direct results of the parasitism are " milder, but always under the form of a congestive state and catarrhal " affection."

Indirect injury inflicted by parasites.

Not unfrequently parasites induce indirectly a derangement of an important organ. We have instances of this in the epileptic seizures or other convulsions of children and of young animals suffering from intestinal parasites.

One parasite may kill several animals.

The parasites, I have to refer to, belong to the three orders of cystocestoid or tapeworms, nematoid or round worms, and trematode or sucking worms. Of some of these, particularly of tapeworms and sucking worms, it is characteristic that in their development they pass through a non-sexual stage, during which they may infest different animals from those in which they dwell during the sexual and reproductive stage of their existence. And thus the same parasite may kill more than one animal. Human beings derive most of their parasites from the domestic quadrupeds. Leuckart says "the chief result of our " observations on the life history of the helminthoid animals is to the " effect that by far the greater number of these creatures live in their

Human beings derive most parasites from the domestic quadrupeds.

“ various conditions in different animals. Applying this conclusion
“ to the human parasites we find that in all probability the greatest
“ part of our entozoa are derived from animals. It is the animals
“ with which we come most in contact, viz., our domestic animals, and
“ especially those we eat that communicate parasites to us—. . . “ The
“ justness of this conclusion is demonstrated without doubt by obser-
“ vations and experiments. The domestic animals furnish us, in fact,
“ with the greater number of parasites, but under different circum-
“ stances. The parasites which we derive from the animals we eat,
“ such as the tapeworm and the trichina belong to the developed
“ intestinal worms. We acquire them in their young state, the tape-
“ worm as hydatids and the trichina as an encysted muscle-worm,
“ and both from pigs, which are the animals that mostly give us the
“ eggs and embryos of their entozoa, which then develop in our bodies
“ in their early condition. Of the encysted parasites the dog, above
“ all others, supplies us with germs. It is it that favours the spread
“ of pentastomum denticulatum, cysticercus tenuicollis, and echinococ-
“ cus from the development within the nasal sinuses of pentastomum
“ tænioides, and in its intestine of taenia marginata and T. echinococ-
“ cus. Also the muscle trichinæ of men may in some cases, especially
“ when they are few in number, be communicated from dog to man.”

a. Measles in the Pig.

Scalesiasis ; cachexia hydatigena ; ladrerie, Fr. ; Finnen Krankheit, Germ. Tænia solium in man.

This malady ignored by veterinarians in this country.

This disease of swine has been entirely overlooked by veterinarians in this country, and it has been only since the researches of V. Siebold and Küchenmeister that British physicians have ascertained the frequent existence of parasites in pigs, which, on reaching the human intestine, develop into tæniæ.

Definition of measles in the pig.

The very inappropriate term “measles” is applied to that morbid state induced by the presence of cysticercus cellulosæ in the muscular structures of swine. It is a purely parasitic disease, and depends for its origin on the introduction into the system of the pig of the mature and fecundated ova of tænia solium.

Development of the measle or cysticercus cellulosæ.

The process of development has been carefully watched by many observers. The embryo from a tapeworm is globular and armed with spines, which pierce, by working in a horizontal plane from within outwards, the mucous membrane of the alimentary canal of the pig. They penetrate the tissues, and are washed through the larger vessels by the blood current until they reach their destination in the muscular structures. A very large number of the embryos are thus dispersed, but only in young animals. They cannot find their way through the tissues of adult pigs, and any experiments performed with animals above a year old fail as a rule. This, as we shall afterwards see, is the same with other parasitic diseases.

Cysticerci can only develope in young pigs.

Cysticerci in newly born pigs the produce of a measly sow.

Pigs are said to be born measly, and one of the most constant means whereby the disease is propagated is by breeding from measly sows. French veterinarians long since noticed that if a measly sow was bred from, all her produce was measly, and similar observations have been made in this country by the bacon factors.

Time required for the development of cysticerci.

If pigs are born healthy they cannot have fully developed cysticerci in their flesh under two months and a half. From 30 to 40 days after the introduction of the germs into the body of the pig the parasites vary in size from one to four millimetres. They consist in small cysts, or bladders, containing a clear fluid, and in the wall of the cyst there are many distinct vessels. A rudimentary head soon appears, and

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then a row of hooks, and lastly, suckers around them develop. Each cysticercus is enveloped in a cyst, its body grows, and is in reality drawn into the bladder, with which it is continuous at the opening, so that the vesicle proper to the animal is in reality the tail. Cysticerci continue to grow for four or five months, but then remain stationary, and, although occasionally killing the animal in whose flesh they have accumulated in countless numbers, they usually have no means of escape until the natural term of the pig's existence is at an end, and then they pass into the bodies of human beings.

Symptoms of measles.

I have seen pigs, in whose flesh cysticerci abounded, in apparently the most perfect health, and very fat. Indeed, it is necessary to examine an animal closely during life in order to determine if it be measly. The parasites are usually situated superficially under the tongue, and may be felt on the inner side of the eyelids. In very severe cases the neck is swollen, there is difficult breathing, and a hoarse voice. I have referred to the practice of measle-trying in the section of this report devoted to the pig trade.

Measle trying.

Appearances after death.

After death the presence of cysticerci is easily seen in the different muscles, and in the internal organs. It is especially when a pig is cut into two halves, and the muscles of the neck are cut through, that the greatest mass of these parasites is exposed. The pork butchers usually make an incision into the psoas muscles to determine if a pig is measly. The presence of many cysticerci in the flesh leads to an open condition of the texture favourable to the imbibition of fluids, and for this reason measly pigs are easily pickled.

Measles very prevalent in Ireland.

Rare in England and Scotland.

Many more animals have a few cysticerci in their flesh than are reputed measly.

My inquiries indicate that measles prevails to a much larger extent in Ireland than in Britain, and may be regarded, in fact, as enzootic in the former country. I have been informed by a Wiltshire bacon factor that not one pig in a thousand reared in England or Scotland is found diseased, whereas the Irish pigs suffer much from this disease, and some years to an extent of six, seven, and eight per cent. The Irish have an adage that every pig has its measle, and if I consider what number of animals have a few cysticerci in their flesh, the per-centage of measly animals is far higher than above stated. When we speak of a measly pig there is an accumulation of many hundred such parasites in the animal's body.

Most prevalent in certain counties in Ireland.

Measles common in Cork, Limerick, Tipperary, Queen's County, Monaghan.

I found that the malady was most prevalent in those counties in Ireland where pigs are reared in small lots by poor people. The disease has diminished considerably of late years, in consequence of the pigs being fed in larger numbers by farmers. I found that measles was very rife in some parts of Cork, in Limerick, Tipperary, and Queen's County. Of the counties in the province of Ulster, Monaghan is by far the greatest sufferer by this disease, and I regret that I have not had an opportunity to follow out my inquiries further as to the causes which lead to the extraordinary losses by this disease in special counties.

Measles most common amongst pigs living free amongst human beings.

Number of germs derived from one tænia solium.

It is certain, however, that those pigs suffer most from measles that live in common with human beings; that are allowed to roam about at will; and to eat human excrement around the cottages, in the roadside, &c. A very few people affected with tapeworm discharge joints enough to contaminate an immense number of pigs. Each tapeworm has an average lifetime of two years. It produces in that time 1,600 joints, and each of these contain 53,000 eggs, making in all 85 millions.* Every egg is capable of developing into a cysticercus, but fortunately the great majority of the joints of a tapeworm are destroyed. Were they not, every pig would soon be measly, and every man, woman, and child suffer from tænia solium.

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* Leuckart, loc. cit., p. 83.

b. Measles in Cattle.

Taenia mediocanellata (Küchenmeister).

Recent researches by Dr. Leuckart demonstrate incontestibly that there is a form of tapeworm, not unfrequently confounded with tænia solium, which does not originate in man from eating measly pig, but from eating imperfectly cooked veal and beef. In many parts of the world a hydatid prevails amongst cattle, which develops into tænia mediocanellata in the human intestine. That hydatid is found in many parts of Europe, and probably exists occasionally in this country. Dr. Cobbold has a specimen of tænia mediocanellata in his collection, obtained from Sheffield, and he informs me that we shall probably find that this variety of tapeworm is not at all rare in this country. Leuckart quotes an observation which interests us as Englishmen. He says that Knox observed a tapeworm epidemic during the Kaffir war in 1819 amongst the English soldiers, due to their being fed on unsound beef. Abyssinians are affected with this disease, and observations have been made in Germany and Russia as to the occurrence of tænia mediocanellata amongst children, fed—"aus diätetischen Gründen"—on raw beef.

Dr. Leuckart has succeeded in inducing measles in the calf, by feeding it with joints of tænia mediocanellata.

As hydatids prevail to a very extraordinary extent amongst cattle and sheep in this country, it is very important that a carefully conducted inquiry should be prosecuted, with a view to determine the existence or non-existence amongst us of tænia mediocanellata, and the cysticerci which induce them.

c. Hydatids of the Liver in Animals, Cysticercus tenuicollis. Tænia Marginata in the Dog and Wolf.

Hydatids of animals.

The pigs in Ireland, and both cattle and sheep throughout the United Kingdom, suffer to a very great extent from hydatids in their livers. Amongst these cystic parasites we find a large number of the species cysticercus tenuicollis. These cysticerci are apt to take up their abode also in the internal organs of man, and it is probable that they often lead to the development of cysts supposed to have been due to the presence of echinococchi, and I am inclined to attribute to this parasite the cystic tumors which Dr. Brinton, and even Dr. Gairdner, consider arise in human beings that eat raw or underdone animal food. Human beings suffer from these cysticerci under circumstances similar to those which lead to the development to cysticercus cellulosæ, and which I have before alluded to.

There is no doubt that eggs of the tapeworm developed from cysticercus tenuicollis in the intestines of the dog, will produce the hydatid in the mesentery and liver of human beings, as it does, according to the experiments of Luschka, Leuckart, and others, in the organs of the domestic quadrupeds.

It is of the greatest importance that careful and extended inquiries should be made as to the prevalence of these cysticerci in animals. It is evident from the observations of Küchenmeister and others, that many individuals of these species, forming extensive cystic tumours, are to be found in pigs, and not unfrequently there has been a confusion between cysticerci and echinococchi. Thus, in Ireland, the endemic cystic disease appears to be due to both these hydatids.

d. Echinococcus Veterinorum, Tænia echinococcus.

History of echinococchi.

Numerous cases have come under my notice of disease in horned cattle, sheep, and pigs induced by this parasite. Von Siebold has shown that tænia echinoccus lives in the dog's intestines, and thousands of thread tapeworms may exist in an animal.

It has been a much agitated question whether there are several species of echinococci. The earlier observers believed in two species, echinococcus hominis, and echinococcus veterinorum. Weinland says, "As to the difference of the two species there can be no longer any "doubt, since the investigations of Küchenmeister and Leuckart." The latter author, however, says, at page 330 of his new work, referring to other authorities on the subject: "They thought themselves so much "the more justified to make this difference, inasmuch as the first "(e. hominis) are characterized by the presence of secondary and "tertiary bladders (tochter und enkelblasen) within them, whereas the "others usually present a simple cystic form. But it is known that the "multiple form of echin. hominis occurs also in the domestic animals, "such as the horse, pig, &c., and, *vice versâ*, it is not rare to find in "human beings the simple forms of e. veterinorum. Sometimes, "moreover, both forms of echinococcus are found in the same indi-"vidual." Leuckart refers to the simple form of echinococcus hominis in some cases, and to the complicated form, e. veterinorum, in others; and, after reference to the shape and number of hooks, concludes by saying: "Naturally under such circumstances I can no longer par-"ticipate in Küchenmeister's views, that there are two species of "echinococcus, and the forms of this parasite indigenous with us are "only varieties of a single species, whose fully developed condition is "to be met with in our dogs."*

Von Siebold on tænia echinococcus.

Tænia echinococcus, first seen by Von Siebold in experiments on dogs, is a small tapeworm with only three or four joints, the last of which, in a mature condition, exceeds in size the remaining part of the body. As a rule their number in the dog's intestine varies from a few to 30 or 40.

I have seen masses of echinococchi, weighing many pounds, appended to the apex of the heart, others connected with the lungs, liver, spleen, kidney, and the last specimens I obtained were in the cranial bones of a bullock. Echinococci are far more frequent in Italy, where I have seen them in enormous numbers, than in the United Kingdom, but they are very common in this country also.

e. Coenurus cerebralis in Cattle and Sheep; Gid, Sturdy, Turnsick.

Sturdy or gid in sheep.

The very common disease, sturdy or gid of the sheep, Dreh-Krankheit of the Germans, prevails to an extraordinary extent in all parts of the United Kingdom where sheep are kept. There are districts comparatively free from the disease, and others where there is an annual loss of one and two year old sheep per score.

From the very satisfactory explanation of the origin of this disease, which is afforded us by a knowledge of the source whence sheep or cattle derive coenuri, I attempted to convince the farmers several years back as to the real cause of the disorder and the ready means of prevention. As the German zoologists had done, I gave dogs the hydatids from the brains of sheep affected with sturdy, and obtained

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* I have had numerous opportunities of examining echinococchi from man and animals in Italy, as well as in this country, and have very frequently studied them carefully. I have always referred to my own observations in the lecture room as leading me to differ from those who considered that there were two species of echinococcus; and during the past session, before I had the pleasure of reading Dr. Leuckart's admirable work, I entered at length in the class-room on the supposed but imaginary differences between the echinococci of man and those of our domestic quadrupeds.

large numbers of tæniæ. The joints of tænia coenurus thus obtained were given to lambs, and sturdy was induced in them.

Experiments on the development of tænia coenurus.

In 1859 I drew up tables showing the results of many experiments performed in different countries on this subject, and 41 experiments as to the development of tænia coenurus showed that of about 50 dogs fed on whole or portions of coenuri from the brains of sheep, 33 became affected with tape worm. As many as 400 tæniæ have developed from one cyst, and the fourth part of one hydatid swallowed by a dog led to the development of 191 tape worms. In less than a fortnight the tapeworms are observed in the intestines, from a line to two in length, showing no trace of joints or transverse folds ; they may attain an inch the third week, and 4 inches the fourth. Worms developed in 155 days are mentioned as being from 2 to 2½ feet in length, but by one experiment it was found that this length could be attained by the tapeworm in less than three months. The tæniæ remain in the small, and obtain exit from body through the large intestine. They are never expelled whole, but separate proglottides or joints, each of which is charged with many hundred eggs, are evacuated with the fæces.

Failure in the experiment depends on diarrhœa causing the expulsion of the cyst before the heads can attach themselves and grow. Occasionally a disease such as distemper may prevent the retention of the parasites.

Experiments on the development of coenurus cerebralis.

To demonstrate that the cerebral hydatids are produced by introducing ova from the dog's tapeworms, 39 sheep and two calves received proglottides of tænia coenurus, and out of these 22 became affected with sturdy. Symptoms of the disease became manifest from 7 days, to 2 and even nearly 4 months after the proglottides had been swallowed by the sheep. The rapidity with which sturdy develops is almost in direct ratio with the length of time, within certain limits, that the joints of the tapeworm have been exposed to the air and moisture. The tardy manifestations of symptoms in some cases probably depends on the ready adaptation of the brain to the developing cysts. The number of coenuri found in the brain varied from 4 to upwards of 200. They were generally distributed throughout the substance of the brain. Encysted and undeveloped embryos are found frequently in the muscular tissue, especially of the œsophagus, intestine, diaphragm, and heart. The experiments fail if proper attention be not paid in procuring mature joints of tænia coenurus.*

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* Until 1853, the period of Küchenmeister's experiments on the transmission of coenurus cerebralis, many were the supposed causes of sturdy. As a matter of curiosity a few may be referred to, and I shall mention those which have been most believed in by farmers and shepherds :—Lullin and Gerike thought sturdy was serous apoplexy, or dropsy of the brain, from violent blows. Many have believed that humidity produced the disease, and Naviéres suggested that a fly deposited eggs in the brain by perforating the skull, and the eggs developed into the hydatid met with in the sturdy. The Ettrick Shepherd stated that sturdy was due to cold affecting the sheep's loins, especially during windy and rainy winter seasons. We have been asked how to explain the prevention of sturdy, by covering the sheeps' loins. Admitting that occasionally this may protect them, we shall afterwards show that all conditions calculated to favour the healthy and robust state of the sheep will prevent the introduction and development of parasites in the body, not excepting the coenurus cerebralis. Fromage de Feugré declares that when lambs are too fat they are most liable to sturdy, and Reynal only recently advocates the theory of Huzard, that those lambs become affected with sturdy which are born of ewes that have suffered during pregnancy, or that are naturally weak ; and, lastly, that the produce of rams of an enfeebled constitution is very subject to the disease. Many shepherds have observed a connexion between the development of sturdy and the presence of dogs amongst the flocks. Many intelligent farmers have a great dislike to dogs amongst sheep, in the belief that by being worried, the sheep become affected with sturdy.

Sturdy affects young animals.

It is a fact that sturdy rarely affects sheep above two years of age usually lambs under a year old; it is more frequently seen in some breeds, such as among the Cheviots, than in others, and affects enfeebled animals, more especially in the autumn and winter months. I find, however, that in some districts there is greater prevalence of sturdy in summer. This occurs when, during the hot months, sheep are kept on unenclosed pastures on hills where they must be constantly "herded," whereas during the winter the flock is transferred to enclosed fields, and dogs are more or less removed from them. Sturdy will always be found to prevail on farms with open pastures, where flocks constantly need the guardianship of shepherds *and dogs*, or on enclosed farms where sheep are fed on turnips, confined daily within limited space, *with one or more dogs amongst them.* These are the conditions favourable to the development of sturdy, and they are those favourable to the dissemination of tapeworm eggs by dogs, and the penetration of the eggs in the bodies of the sheep. These eggs find a favourable nidus in the cerebral mass of the lamb, and they there develop into the coenurus cerebralis.

Symptoms.

Sturdy is occasionally confounded with other diseases, and my attention has sometimes been called by farmers of great experience to a sheep presenting certain anomalous symptoms, which though distinctly due to the presence of the coenurus cerebralis in the brain, have not been considered those of sturdy. The variety of ways in which the sturdy manifests itself, depends entirely on the number of, and the position held by the parasites in the brain. Usually, but one hydatid is found within the skull, sometimes several, and then the symptoms are complicated.

The usual form of sturdy depends on the presence of a hydatid in one of the hemispheres of the cerebrum, or brain proper. The sheep then turns right or left according to the hemisphere affected. If the bladder be situated between the hemispheres, the head is protruded and elevated, and the animal moves in a straight line forwards. Lastly, if the bladder be lodged in the lesser brain or cerebellum, there is defective co-ordination of movement; the creature loses control over the voluntary muscles, there is a peculiar uncertainty of gait; the limbs do not obey the will.

In addition to the above symptoms there are others which have not been studied as much as they might have been, though of great interest to the physiologist. Such signs are peculiar to different stages of sturdy. We observe that when first affected, the symptoms are very severe; there is much cerebral disturbance from the congestion produced by the presence of the hyatid. As the brain substance yields to the latter and is absorbed—in other words as the contents of the skull adapt themselves to the parasite,—the symptoms may subside more or less, and a sheep decidedly giddy, stupid, and dull at first, may appear partially to recover; but the growth of the parasite, or any cause favouring cerebral congestion induces a marked exacerbation of symptoms. But, as Dr. Davaine has correctly stated, the vertigo cannot be explained as depending on simple morbid irritation, or looked upon as a symptom of paralysis or incomplete hemiplegia. The attacks of giddiness, the running round and round, become more frequent and are more prolonged as the hydatid grows; the rapidity of movement increases until paralysis is induced, and the animal cannot stand. Many tumours and hydatids of a different species to the coenurus cerebralis are met with in the brain, but the peculiar symptoms of sturdy are not induced by them.

Dr. Davaine's explanation of the symptoms of sturdy.

The coenurus consists in a bladder provided with a variable number of exsertile heads, and Dr. Davaine believes the nervous substance

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may be excited by the heads, which protrude from the bladder and penetrate the brain substance nearly two lines in depth. Sturdy is, therefore, a phenomenon of excitation of one of the cerebral hemispheres, and Dr. Davaine asks if very manifest phenomena of excitation would not result by plunging into the substance of the brain one or two hundred pin-points at a depth varying from one to two lines. As the coenurus increases in age, the number of heads augment, and the points of contact with the encephalon multiply, and in this way Davaine explains the increase in frequency and duration of the vertiginous attacks as the malady advances.

It is certainly remarkable that though the echinococcus veterinorum may lodge in the brain of sheep or oxen, it does not produce the characteristic symptoms of sturdy caused by the coenurus cerebralis, and the probable explanation to this is, that the heads of the former are not exsertile, whereas those of the coenurus protrude from the distended cyst.

The vertigo observed in true sturdy is altogether peculiar; that is to say, the lamb turns round and round, describing concentric circles, and Davaine states that it has been entirely by false analogy that some authors have admitted the existence of sturdy in man.

Admitting that the coenurus cerebralis exerts a peculiar influence on the brain, it must be remembered that the "running round" is not a constant symptom. In the early stages it is often absent, the sensorium and voluntary muscles being more or less affected with dulness and partial paralysis, stiffness of back and awkward gait; there is a peculiar appearance of the eyes dependant on the dilated pupils, the bluish colour of the conjunctiva, and apparent prominence of the eye-ball. Total blindness may result, and the animal feeds but little, cannot follow the flock, strikes against trees, walls, or other obstacles, which it may meet with in moving about.

When the coenurus cerebralis exists in the cerebellum, a remarkable combination of symptoms may present themselves. The animal advances with its head elevated, can scarcely lift its fore legs, and there is a hesitating movement of all the extremities. Having accomplished the first steps, the creature rapidly advances, occasionally by a succession of imperfect leaps and falls; it then struggles to rise, and may not succeed, or it rolls on its side several times in succession. Emaciation advances and death ensues sooner or later, but as a matter of certainty, unless the animal is relieved naturally or artificially. The natural method of relief, which is by absorption of the bones of the skull, and evacuation of the hydatid, is very rare, though occasionally a farmer is astonished to learn that a sheep affected with sturdy has struck against a sharp stone, broken its head, and recovered. The explanation of this is, that the skull having become thin, the blow produces a penetrating wound, through which the coenurus cerebralis may escape. A plan is successfully resorted to occasionally for the removal of the hyatid and cure of sturdy.

Sturdy is occasionally mistaken for functional disorder of the brain due to impaction of the third stomach, which is a disease of the spring season, of an acute nature, characterized by constipation, delirium, convulsions, and early death, unless the animal be relieved by a brisk purgative.

Sturdy is also confounded with the attacks of the sheep-bot, which is lodged in the frontal sinuses, and produces great irritation, swelling of the pituitary membrane, and discharge from the nose. The animal loses appetite, becomes dull, prostrate, is attacked with convulsions, and sometimes dies.

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f. Rot in Sheep ; Cachexia aquosa ; the Fluke Disease ; Attacks of Distoma hæpaticum.

Ravages by rot. Professor Simonds' statement.

This most destructive disease has attracted more than ordinary attention of late years owing to its extraordinary prevalence in 1860, and also in the year now closing. Professor Simonds in a recent essay on this malady * says, after referring to a number of extraordinary outbreaks : " From 1830 to the present time several visitations, which " were more or less severe, took place. One of these occurred in " 1853–54, when many thousands of sheep were swept away, and not " only in undrained districts, but also in others of a more healthy " character. Since 1830, however, no outbreak can at all be compared " to the one of the autumn and winter of 1860. Speaking in general " terms, it may be affirmed that all the western and southern counties " of England, together with several of the eastern and midland, " suffered to a ruinous extent. As in former years, so in this, the " attacks of the disease were due to an excess and long continuance of " wet weather. Eighteen hundred and sixty will be long remembered " by agriculturists, not only as producing the rot among sheep, but " likewise for its baneful effects on the root crops as also on the hay " and corn harvests.

" We are acquainted with several instances, in our own immediate " neighbourhood on the verge of London, where the losses of sheep " amounted from 600 to 700 in a flock. These sheep were principally " Welsh ewes, which had been bought at the latter part of the summer " for breeding by being crossed with Leicester tups. Some persons " lost nearly all, and one in particular, who buys about 800 of these " ewes annually, had not more than 40 or 50 which escaped. Tups, " wethers, lamb-hogs, and half-breds, alike succumbed to the inroads " of the affection. A similar fatality attended the progress of the " disease in all other districts. In many parishes in Devonshire where " we investigated the malady, and of which Bridgerule may be taken " as an example, five-sixths of the sheep perished, or were sold for a " few shillings each for slaughtering, to the detriment of the health of " the poorer classes.† In the instance thus particularized the losses " occurred among the stock of small occupiers, the ill consequences of " which were greatly added to by their young cattle being found to " be affected with flukes to such an extent as seriously to injure their " health later on in the year.

" In Sussex and in several parts of Surrey, the fatality was equally " great. In the neighbourhood of Eastbourne a flock of about 600 " Southdown ewes of great value was completely destroyed. Numerous " cases of this kind might be narrated, but enough has been said to " show not only the extent of the disease, but that sheep of every " description, and placed under different systems of management, " equally succumbed. It is much to be regretted that means do not " exist whereby the total loss could be ascertained. People are left in " doubt as to the amount of food of which they were deprived in one " year by this disease alone, and of the efforts which must be made to " replace the losses. The time, we predict, cannot be far distant when " agriculturists will be convinced, not only of the propriety, but of the

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* The Rot in Sheep, its Nature, Cause, Treatment, and Prevention, by James Beart Simonds, London, 1862.

† The Rev. S. N. Kingdon, the resident minister at Bridgerule, reported to the author, that on October 1st, 1860, 492 sheep were existing in the parish as the joint property of several small farmers ; and that, by the end of the month, 410 of them had either died or been sold at a price very little above the value of their skins.

" positive necessity of making returns, at least of the *losses*, they " sustain among their cattle, instead of simply deploring these among " themselves. Elsewhere we have drawn attention to this important " subject, upon which very much might now be said, if it were not " somewhat unsuited to an essay of this kind."

Mr. Spooner on losses by rot.

Mr. Spooner in his work on sheep, says, " Though a million of sheep " or lambs have frequently been destroyed annually by this disease, in " the winter of 1830–31, this number, it is supposed was more than " doubled; some farmers lost their whole flocks, others a moiety, " and many were ruined in consequence. These facts were proved " before a committee of the House of Lords in 1833, and it was there " stated by one farmer that he lost 3,000*l*. worth of sheep on his farm " in Kent, in the course of three months. Even at this time there " were 5,000 less sheep taken to Smithfield every market-day in con" sequence of the mortality two years previously, so extensive and " general had it been."

Losses in 1862.

My inquiries in 1862 indicate that the mortality in many parts exceeded that of 1860. It has far surpassed it in Ireland; and amongst the most extensive sheep dealers in the midland counties and the south of England I have learned that the destruction over extensive districts has been almost unparalleled in their experience.

When I was last in Dublin (13th December) my advice was asked concerning this disease, which seems to have prevailed on lands usually quite free from rot, and I learned that the malady was very destructive in Kilkenny amongst cattle. Serious complaints have been heard from Clare, Limerick, Roscommon, King's County, Wexford, parts of Kildare, Longford, Leitrim, and Armagh. I am quite certain that not less than 500,000 sheep have this year suffered from rot in the United Kingdom, reducing them in value two-thirds and more, and leading to a loss of several hundred thousand pounds to the country at large.

Causes of rot.

Rot is a disease of low lands, marshy ground, and wet seasons. Flooding pastures suffices to render them unsound for sheep for a season, and this is owing to the dissemination of distomata in their partially developed condition, and fit for their term of existence, in the ruminant's liver. Apart, however, from the prevalence of flukes on low land and especially marshy pastures, we find that sheep do not keep up in condition on soft watery grass. Solid dry food suits the constitution of the sheep best, and during wet seasons we find rot prevailing to an alarming extent on sound lands, and on opening the bodies of the sheep very few flukes are found in their livers. Notwithstanding the existence of flukes in the liver it is possible to counteract the state of weakness, and stop the progressive emaciation by rich food, tonics, and common salt, which do not tend to expel the parasites so much as to counteract the condition of the system induced by quality of food the animal has been on, coupled with the morbid changes in the liver from the presence of the flukes.

Rot develops most readily from the month of June to the month of October.

Natural history of the fluke.

The fluke, distoma hæpaticum, is found in the livers of sheep in a perfect condition, with organs of generation developing or developed, and masses of ova surround the parasites. They are often packed together in scores in saccular dilatations of the gall ducts, and I have seen the most extraordinary specimens of livers, with varicose gall ducts encrusted with cholesterine and other solid principles of bile. The ova, which abound in the gall ducts, pass out through the intestine of the sheep and fall into stagnant pools, ditches, &c., or are washed from the land during rains into streams. Most of the ova are fortunately

APPENDIX.

IV. Cattle diseases in relation to supply of meat and milk. By Mr. Gamgee.

destroyed as a rule, but many are hatched, and embryos develop. Steenstrup's investigations on this subject were very remarkable. The embryos were found to acquire great activity, and would move freely, owing to the vibratory cilia formed in their surface. They are eaten by mollusks, the common physæ or limneæ of pools and ponds. The embryos here acquire a sort of hydatid form, are provided with alimentary canal and organs of locomotion. By a process of interior budding *cercariæ* form, which are the young sucking worms, endowed with great activity, and thanks to a rudder tail, which renders them not unlike a tadpole, they can swim and find their way into water; where they live free until some favourable *crustacean* or mollusk appears, into which they pass by means of spines developed on their head. They lose their tail and become encysted; their internal organs continue to develop, and on the animal they are infesting being accidentally swallowed by a sheep or other creature, they escape free to pass into the liver, acquire generative organs, and lay eggs for another generation. The metamorphoses here noticed are probably similar for all trematode worms, and are presumed to be those of distoma hæpaticum, whose cercaria form has not been discovered.

Sheep are very liable to suffer from parasites, and in conjunction with the flukes in the liver, we usually find parasites in the lungs and parasites in the stomach. Mr. Simonds refers to having recently " brought to light another and a fruitful cause of the death of sheep " of all ages," with symptoms " remarkably akin to those of rot," and due to " the existence of an undescribed variety of worm of the class " *filaria* within the abomasum,—the digestive stomach." The truth is, that the parasite Professor Simonds refers to, from the brief notice he gives of it, is one which has been frequently referred to before, and is noticed in all German, French, and Italian veterinary works which are at all up to date in matters of science. Bellingham long since noticed the occurrence of strongylus contortus in the sheep in Ireland. He found it in the small intestine, but it is as a rule found in the fourth stomach. It was first described by O. Fabricius in Denmark, who stated that the head of the worm was armed with cilia, probably the barbs which Mr. Simonds has noticed. The German authors refer to the disease induced by the gastric parasites in sheep as a " Magenwurmkrankheit." Spinola calls it Magenwürmerseuche or strongylogenesis ventriculi, and characterizes the disease as " eine cachectische herdekrankheit."

It is, moreover, in the condition of system noticed in sheep rot that many other parasites prey on the bodies of living animals, and echinococci, cysticerci, &c. are not uncommon in rotten sheep.

Symptoms of rot.

Symptoms of rot: A flock placed on damp land, or a flock purchased from a country where it has contracted rot, appears to thrive well, lays on fat, and promises to turn into good mutton. Inactivity and dulness are soon apparent. In some cases the disease is rapid in its course, and this season (1862) a large number of sheep have been killed very quickly on lands usually reputed as very sound. Pallor of the visible mucous membranes, wasting, &c., could be seen in these sheep, but only to a moderate extent, and they have died very suddenly. After death the liver has been found greatly enlarged, its peritoneal surface often adherent to the diaphragm and other abdominal organs, and few flukes contained in the liver. The small quantity and pale character of the blood indicate, however, the real condition of the sheep.

As a rule rot progresses at first in an insidious form; the flanks get hollow, the back rigid, and there is a decided yellow colour of the eye, and, where visible, often of the skin; the fleece drops off in patches;

the belly enlarges ; the back droops ; and there is a disposition to dropsical swellings in different parts of the body. There is frequently an insatiable thirst as in other dropsical diseases, the pulse is frequent and very feeble, the heart beats active, and anœmic murmurs are heard ; the breathing becomes quick and short, there is a slight cough, most marked in all cases complicated by the presence of strongyli in the air passages.

The most remarkable of the dropsical swellings is around the throat. A sheep thus affected is said to be *chockered.* The alimentary canal is disturbed, and, with the quantity of liquids drank, diarrhœa is apt to supervene. Weakness and listlessness, amounting to a state of stupor, increase, and the animals die in a hectic state.

q. Parasitic Disease of Lungs in Calves and Lambs. Phthisis pulmonalis verminalis, Lungen-wurmseuche.

Parasitic disease of lungs.

Next to rot this is by far the most destructive disease of young sheep in the south of England. It is not so destructive in Scotland, but has injured farmers much this season in Ireland.*

If the lungs of sheep are examined in butchers' shops a very large number of them will be found studded with deposits, once regarded as tubercular.†

This tubercle, in reality, consists in a deposit of ova of the *strongylus filaria* (Reed), surrounded by epithelium and granule cells, oily and crystalline deposit, with debris of healthy lung tissue. Generally this opaque and semi-gelatinous material is observed towards the more healthy part of the lungs in the shape of circumscribed masses, often not exceeding the size of an ordinary pin's head, and if each little nodule be squeezed, a gritty substance, the result of cretifaction of the above mentioned deposit, is felt between the fingers. Each nodule indicates a spot where the germs of the strongylus filaria have been deposited, giving rise to irritation and the exudation of material around them ; in this material granule and pus cells develop, and fatty, and lastly calcareous, degeneration ensue. The eggs are of an oval shape. They are at first transparent, but in all those that are fecundated the yolk cleaves, and by progressive subdivision of cells formed out of the yolk a cellular mass is formed which assumes an enlongated and coiled appearance, and presents the external form and internal organisation of the strongylus filaria. The parasite, coiled on itself and alive in the cell, moves about and at last becomes free and grows to its full size, passing out of the tissue of the lung into the air passages, whence it is coughed out and often deposited on grass and other substances likely to be eaten by the sheep. How it attains the lungs to deposit its eggs is involved in mystery,—perhaps by directly piercing the tissues from the stomach to the lungs ; though, from the eggs being universally disseminated over the lung, we might be led to conjecture that the ova are introduced into the circulation and stopped in the pulmonary capillaries, where they produce irritation, and the deposit, before described, accumulates around.

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* As an indication of the importance of this disease, I may mention that the farmers of Cornwall, through the Bath and West of England Society, recently offered a prize of 30*l.* for an essay on this disease, which has been awarded to Dr. Edward Crisp, who proves that the disease is due to overstocking, and especially to the feeding off a second crop of clover with lambs after the first crop has been consumed by sheep.

† I was not aware myself of the real nature of this deposit until 1854, when I had the privilege of prosecuting, with Dr. Ercolani, of the Turin Veterinary School, some researches as to the methods of propagation of parasitic worms.

The strongylus filaria is a worm from one to two and a half inches in length, the male smaller than the female and yellowish, whereas the latter is white. The body is of uniform size, but tapered at the extreme ends. Anteriorly is the head, short, stumpy, and matted, not tuberculated as that of other strongyli, but rather angular. From the mouth extends a short œsophagus into a short but elongated stomach, and from this the straight intestine extends back nearly to the extreme end of the tail, a little anteriorly to which is the anus. In the male an undivided circular aliform expansion, obliquely situated to the line of the body, surrounds a space in which the penis is observed. The tail of the female is pointed, the vulva situated near the anus, and from the vulva extend the oviducts full of eggs, and containing also live young.

Strongyli in air passages of calves and pigs.

In calves similar parasites abound under certain circumstances in the respiratory organs. The *strongylus vitulorum*, Reed, or *str. micrurus*, Mehlis, is one of the armed strongyli with a filiform body, short caudal, long in the male, and mouth with three papillæ. This species is met with in the air passages of calves, and occasionally in the ass. Nicholls, in the first volume of the Philosophical Transactions, mentions the *husk*, common amongst calves under one year old, as dependent on worms in the windpipe ; and in 1788, when Camper was engaged in investigating the cattle plague, and especially the advantages of inoculation as a preventive, he learned that one of his neighbours who had saved 50 calves by inoculation, lost 30 by this parasitic affection. On the 2nd of September of the same year, Camper had occasion to examine the trachea and lung of a calf that had died, as he expresses himself, with myriads of these worms in the air passages. On another calf Camper noticed a perfect ball of these worms effectually obstructing the windpipe. He described the worms well, and observed that they were viviparous. In his literary researches on the subject he found that Gesner had called a worm *Wasserkalb*, calf of water, of which he knew not the origin, but that calves swallowed them with the water to the great peril of their lives—*magno etiam vitæ periculo.*

In the pig a similar affection has been observed, and the worm has been described best by Mehlis and Gurlt. It has been called *strongylus paradoxus*, Mehlis ; *gordius pulmonali apri*, Ebel ; *ascaris filiformis cauda rotundata*, Goeze ; *asc. bronchiorum suis*, Modser ; and *strongylus suis* by Rudolphi, who looked on it as a doubtful species, having seen but two specimens which he had received from Bremser, and which had been found in the air passages of the domestic pig. Gurlt speaks of them as infesting the wild boar and the domestic pig, but that it is rare. Alessandrini, on the other hand, says that in Bologna he has found large numbers in the lungs of pigs killed in the public slaughter-houses, and it has since been recognized as frequent in Switzerland and France. The *strongylus paradoxus* has a narrow mouth, furnished with three papillæ ; the caudal bag is bi-lobed, and turned downwards. In the female there is an enlargement where the anus is observed ; the tail is short and pointed. The male is from eight to nine lines in length, and the female about an inch and a half. The females are by far the most numerous of the two.

Two stages of the parasitic lung disease.

Returning now to the parasitic disease of the lungs of sheep, it is clear that there are two distinct stages of the affection, the one mistaken for true tubercular disease, and the other when the worms are fully developed, and lodged in the air passages. Waldinger* was probably the first to give a good account of the latter stage, but the

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* Abpaulung äberd Wurmer und Lungen a Staape. Wien, 1818.

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nature of the first was not brought to light until 1840, when La Harpe, of Lausanne, examined the affected lungs, and discovered the ova and young worms in the solid deposit, and recognised them as analogous to the strongylus filaria, met when full grown in the air passages, and sometimes in the act of piercing from the lung tissue through the mucous membrane into the bronchia.*

Dr. Ercolani's observations.

Unaware of La Harpe's discovery, Dr. Ercolani in 1843, when prosector to Professor Alessandrini in the University of Bologna, was struck with the appearance presented by some sheeps' lungs he had purchased on the butcher's stall. Many strongyli existed in the bronchia, and grey nodules or tubercles on the surface of the lungs. These nodules Ercolani found to contain small worms and eggs, in which the young strongyli were in a state of development, already alive and active. Since then Ercolani has made some interesting observations on the tenacity of life of the young strongyli. These parasites show signs of life on being moistened after drying for 30 days, and at other times after having been immersed in spirits of wine at 30°, or in a solution of alum and corrosive sublimate. Ercolani, moreover, says that the ova, abundant in the mucus of the bronchial tubes, containing worms, sink into the air vesicles, become coated by an albuminous material, and thus are imbedded in the lung tissue. This would lead us to believe that when worms are swallowed by healthy sheep they immediately find their way into the windpipe. I must confess I doubt this. Of course the eggs of the worms developed in the lungs are deposited in the lungs again, or may move indirectly into the system of another animal, but the migration from the mouth or alimentary canal to the lungs, certainly requires a more complete explanation than has hitherto been given. The number of embryo worms met with in the lungs of one sheep is sufficient to infect a whole flock, so that the disease has manifested itself as enzootic and epizootic.

Dr. Hall's remarks.

Perhaps as early as La Harpe and Ercolani, did Dr. C. Radcliff Hall, of Torquay, investigate the question. In 1856, in the British and Foreign Medico-Chirurgical Review, Dr. Hall says, "For fifteen years "past I have been in the habit of noticing the lungs in butchers' shops "and slaughter-houses. I have never seen a single specimen of the "lung of a full grown sheep that was entirely free from entozoic "disease. The disease is not hereditary, since the lungs in young "lambs are healthy. Nor, I conclude, is it restricted to any specific "locality, since I have found it at every place in Great Britain, "France, Germany, and Switzerland that I have happened to visit. "The lungs, then, of any full grown sheep, taken indiscriminately, will "be found to contain, and often to be thickly studded with, small "nodules, varying in size from a pin's head to a barleycorn, or larger. "The cysts are full with clear fluid, and contain cysticerci hanging "upon an epithelial lining membrane. The firm soft deposits consist "of granule cells and molecular matter, in which minute ascaris little "worms are found. The gritty nodule is one or other of these, which "has undergone calcareous transformation. The particular point "bearing upon my subject is, that the pulmonic affection does not "prevent the sheep from furnishing excellent mutton." Further on Mr. Hall has introduced a diagram to show the changes undergoing around the germs of the strongylus in the lung tissue, and says that

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† I do not agree with Dr. Crisp's theory of the germs of the parasite being carried back from the stomach to the mouth in the act of rumination, and then finding their way into the trachea. As with the germs of the cysticerci only the young animals are affected, because they cannot pierce the tissues of older ones.

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Dr. Ranke's researches.

"there is nothing during the lifetime of the sheep to lead us to infer "that it suffers pain, distress, or constitutional disturbance during the "formation of this boundary of plastic inflammation around the nodules "in its lungs."

Dr. Ranke exhibited at the Pathological Society on Tuesday, November 3, 1857, the lungs of three sheep affected with the disease, which Dr. Ranke stated "is now very prevalent among those animals. "The lungs were studded with a great number of gelatinous looking "bodies, mostly of a yellowish colour, varying in size from that of a "mustard seed to that of a bean. The smallest are generally roundish "and almost transparent; sometimes they show an opaque white point "in the centre, and others are nearly black, resembling small shot. The "larger ones are mostly irregular in outline, opaque, and of a dirty "yellowish colour. Consistence varying, sometimes soft, sometimes "almost cartilaginous, and occasionally hard and chalky. Pulmonary "tissue between the bodies perfectly permeable to air. All these bodies "contain the brood of a species of entozoon (strongylus filaria) in "different stages of development. The large irregular bodies contain "the old female worm and countless ova, and young worms in their "earliest stage, mixed up with great quantities of cells resembling "pus corpuscles, compound granular cells, granular matter, &c.; while "the small rounded bodies form a pseudo cyst, and contain, coiled up in "the same kind of exudation matter, one young worm attaining to "maturity. The size of these solitary young worms greatly varies; the "smallest are found in the semi-transparent bodies, and the largest "being nearly full grown, and having their genital organs developed, "are found in the dark cysts. The exudative matter in the cysts "seems to form the food of the young worm."*

On examining the sheep slaughtered we find that the large number of them are fat and robust, yielding wholesome meat, but there is likewise a per-centage, and not a small one, conveyed to the butcher, because feeding cannot improve them, and to allow them time would be to allow them time to die by the disease, which has been termed *phthisis pulmonalis verminalis*, or if not, with an extraordinary accumulation of flukes in the liver. That the development of the germs in the lungs is unattended with the slightest inconvenience, as mentioned by Dr. Hall of Torquay, we very much doubt, and though the worms may not have found their way into the air passages, the changes going on in the early stages of the disease are associated with symptoms of spasmodic cough, irritation in the throat, and occasionally, as some of the small worms get free and coughed up into the nasal chambers, the sheep may be seen rubbing their head and nostrils on the ground, and snifling to remove the cause of the irritation. It rarely happens, I believe, that large accumulations of worms in the

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* Dr. Ranke stated that he was not aware that any description of this development of the strongylus existed, although the worm in its adult state, when it is found in the bronchi and trachea of the lungs of sheep, goats, calves, &c,, has been long known. Mr. Simonds, Professor of Cattle Pathology at the Veterinary College, Camden Town, with whom Dr. Ranke has communicated on the subject, had, however, informed him that he himself had some time ago observed the ova and young worms in the large patches. The disease seems to be just now exceedingly common; of eighteen lungs which Dr. Ranke examined, there were only two or three in a healthy state. As regards the effect of lungs so diseased being used for food, Dr. Ranke had made an experiment on a cat, but with a negative result. The animal was exclusively fed on such lungs for a fortnight, and then killed. It had shown no signs of disease during life, nor were any traces of the worms to be discovered, either in the intestinal canal or in any other organ. In the meat of sheep affected with the above-described disorder of the lungs, Dr. Ranke failed to discover the entozoon.

lungs do not lead to emaciation, anæmia, and defective nutrition, with great debility and dropsy, unless the animals are suffocated by a lump of worms closing the windpipe.

It has been thought by some that the constitutional condition must precede the deposition of the germs and the development of the strongyli in the respiratory organs, but that this is not correct is proved by the animals continuing to thrive until by the number of full grown worms the breathing is disturbed, the sheep are tormented, and fall back in condition. Other parasites accumulate in the liver or in the alimentary canal, and the animal falls into a state of hectic, with a manifest tendency to dropsy.

l. On Trichina Spiralis.

Human beings derive trichinæ from pigs.

It is quite evident that human beings in this country suffer to a large extent from the prevalence of measles in the pig, but the facts which have come to light within the last couple of years would indicate that we suffer far more seriously from eating in pork the destructive parasite on which I have at present a few words to say.

Early observations of Trichina spiralis.

Mr. Hilton, then demonstrator of anatomy at Guy's Hospital observed in 1832 a peculiar appearance in human muscle which he thought depended on the formation of a very small cysticercus. Professor Owen described the parasite in 1835, and named it Trichina spiralis. He found it in the superficial muscles of man more than the deep. Mr. Turner, demonstrator of anatomy in the University of Edinburgh, has also found this to be the case: "The pectoralis major, trapezius, " latissimus, and external oblique, containing more cysts in a given " space than the pectoralis minor, rhomboidens, and internal oblique " or transversalis. Moreover the cysts are much more extensively " distributed near the superficial than the deep surface of the same " muscle." A fact of considerable interest, for it shows the tendency which the worms possess to work their way towards the exterior.*

The parasite has been very frequently seen in the human body since Owen described it, and it is believed by some that it occurs perhaps more constantly and frequently than the great majority of entozoa of man. Mr. Turner said in 1860 that between one and two per cent. of the dead bodies which had come under his observation during five years had been affected by it, and in reply to a note I addressed Mr. Turner a short time since, he states that his observations during the two years which have elapsed since the publication of his paper in the *Edinburgh Medical Journal* have tended to confirm the opinion he then formed as to the frequency of the trichina in man.

To discover whence this parasite is obtained by man was therefore a matter of very great moment. And it is well known now that the lower animals, and especially pigs, are infested with it to a very extraordinary extent. I have seen it in the flesh of swine, and hope to have opportunities of making further inquiries on the subject.

The many suppositions as to the nature of trichinæ, and whether they were larvæ of trichosomæ, or the young of tricocephalus dispar, were set at rest by Virchow and Leuckart.

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* The description of the parasite is as follows :—
Gen. TRICHINA. Animal pellucidum, filiforme, teres, postice attenuatum; ore lineari, ano discreto nullo, tubo intestinali genitalibusque inconspicuis. (In vesica externa cellulosa elastica, plerumque solitarium.) Sp. TRICHINA SPIRALIS. Minutissima spiralites, raro flexuose incurva; capite obtuso, collo nullo, cauda attenuata obtusa. (Vesica externa elliptica extremitatibus plerumque attenuatis elongatis.)—Untersuchungen über Trichina Spiralis Von Dr. Rudolf Leuckart, Leipzig, 1860.

Herbert fed three dogs with the trichinatous flesh of a badger in 1852, and after having kept the dogs alive several months found trichinæ in their muscles. Virchow, Leuckart, Zenker, Turner, Haubner, and others have since given trichinæ to pigs, cats, dogs, rabbits, &c., and found trichinae with their organs of reproduction developed, and undergoing changes in the formation of other parasites in the intestinal mucus. These pierce the walls of the intestine and many penetrate blood vessels, are distributed in the blood over the whole muscular system, where they become encysted.

It is no longer doubted that human beings receive trichinæ from the animals they eat, and it does appear that dangerous symptoms and fatal consequences may ensue after such importations.

III. ÆTIOLOGY OF THE PRINCIPAL CATTLE DISEASES WHICH AFFECT OR THREATEN THE UNITED KINGDOM.

1. *Epizootic Diseases.*

a. Pleuro-pneumonia in Cattle.

It has been said by Delafond and others that pleuro-pneumonia is seen as a sporadic and enzootic disorder in the Pyrenees, Alps, Jura, and Vosges, and in the uplands of Hesse, Suabia, and Silesia.

It is certain that pleuro-pneumonia exists constantly in the Prussian dominions. It is very prevalent in Bavaria and other German states, but according to Röll not very common in the Austrian dominions.

There can be no doubt that, whatever may be the cause, there are districts, by no means all mountainous, and I think as a rule, rather the reverse, which may be regarded as settled "stations" of the disease. These "stations" are probably the seats of the disease from the constant traffic in cattle through them, and I mean by a station no more than a locality into which disease has been introduced and where it has been kept up by influences constantly favouring the attack of fresh animals. Many of these, either convalescent or actually diseased, carry the disorder beyond the limits of such "stations." In Britain all our large towns are stations for this disease. The weekly purchases in foul markets lead to the uninterrupted prevalence of pleuro-pneumonia in many cowsheds, and from these diseased animals issue to contaminate the stock they come in contact with. In my travels I have found many cattle dealers' farms which have been true "stations" for the spread of pleuro-pneumonia. Professor Gerlach says that it is most probable that pleuro-pneumonia was not originally a European disorder, but that the periodic outbreaks over the continent during the last century have had apparently as their starting points certain established stations, such as the districts noticed by Delafond.

Large towns are the British *stations* for it.

Beyond these well defined spots, which are rather widely scattered over the continent of Europe, but chiefly in its centre, the malady always spreads in the lines of communication established between distant parts by either war or trade. Thus in the eighteenth century the outbreaks of the disease (as also of the Russian cattle plague or steppe disease) were due almost entirely to the constant warfare in which the armies of every European nation were engaged. Pleuro-pneumonia owes its extension likewise to trade, and on this point I am in a position to furnish a large mass of substantial proof. Firstly, from the general history of the disease and its geographical distribution at the present moment; secondly, from the history of separate invasions of counties, estates, parishes, and farms; thirdly, from facts

Outbreaks in the 18th century due to wars.

Proof as to the contagious nature of pleuro-pneumonia in cattle.

relating to the constant prevalence of the disease in large towns; fourthly, from the results of experimental inquiries in Germany and France; and, fifthly, from the results of my own experience as to the means which check the progress of the disorder. And besides this proof I can appeal to all the best reputed literature of veterinary medicine.

First, I have to deal with that which is matter of fact in relation to the repeated manifestations of the disease on fresh soil, and the course which it has taken.*

History of the disease in travelling to England.

The great point is to establish how the disease has passed from country to country so as to lead to the present frightful condition of herds on British soil. We need not go very far back. Towards the end of the 18th century, and beginning of the present one, the continent of Europe, the scene of perpetual strifes, continued to be overrun by the disease. In the days of Waterloo the malady had penetrated France, Belgium, Hanover, and Holland. It was everywhere but in England and the extreme north of Europe. It even followed Napoleon into Russia. All this was due to the necessities of large armies. They required cattle both for their transports and for food.

At the beginning of this century the disease was over the whole continent.

Peace chec its spread, but led later to other means of communication between different countries. Establishment of starch and sugar manufactories and of distilleries where cattle had to be kept. Populations increased. Insidious manner in which the lung disease penetrates countries.

A long peace, and the activity of many Continental governments in checking the spread of contagious disorders, led to the salvation of much stock. Pleuro-pneumonia receded to its usual haunts in central Europe,—to Silesia, Prussia, Austria, and the Rhine provinces. Its outbreaks were very partial, and its form benignant. With peace and prosperity came the development of various industries, and perhaps the most important in relation to the spread of this cattle disorder, was the establishment all over Germany, Belgium, and some parts of Holland, of distilleries, and of starch and sugar manufactories, &c., which have increased in importance and number up to the present day. The manufacturers soon found that their refuse must be eaten by stock, and the feeding of cattle on grains has since annually increased. Populations also increased, and the cattle trade became more active in consequence. Russian, Polish, and Hungarian dealers travelled large herds of cattle westwards. The invasion of a territory by pleuro-pneumonia is insidious. The disease commonly escapes observation as it steals into a farm or country, and is consequently perhaps more destructive than any other known epizootic disease.

1824—1830.

Between 1824 and 1830 it raged here and there throughout Bavaria, Würtemberg, Austria, Prussia, and the Rhine provinces.

Holland.

As we owe this disease unquestionably to our Dutch trade, it is interesting to notice its gradual progress towards our shores. It first

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* It is undoubted that during the last century revolutions and war led to constant outbreaks of contagious disorders, which more than decimated farm-stock; and pleuro-pneumonia was one of the diseases which especially attracted attention. It was worked earnestly at by many eminent men, including Haller. The immortal physiologist of Zurich says:*—"*above all we must abandon all hope that the lung disease is* "*not a contagious disease.*" . . . "At all events, it is certain that in our lands, as "often as the lung plague has appeared amongst cattle, the origin of the disease has "been *always* traced to the purchase of an animal from a suspected market, or to one "brought from an infected district into our land. At other times our country people "have fattened cattle with other cattle from infected parts."

Haller lived in Zurich. His observations apply to Switzerland generally, I suppose; and it is the decided terms in which so great an observer writes that first created doubts in my mind as to the spontaneous origin of the lung disease, even in the mountains of central Europe, which have been so well defined by Delafond. I feel inclined to look further than Europe, and in hotter climates than those of Germany, France, and Switzerland, for the spontaneous development of the disease.

* Abhaudlung von der Vichseuche.—Berne, 1773.

1833 in Gelderland.

appeared in Holland on the Prussian frontier six years later than its manifestation in Belgium. In 1835 the malady was transmitted from Gelderland to Utrecht. It reached South Holland immediately afterwards, and prevailed especially near the great cattle markets of Rotterdam and Schiedam. The islands of Zeeland then began to suffer at various parts wherever South Holland cattle were injudiciously imported, and some outbreaks were attributed to infected cattle from South Holland, North Brabant, and West Flanders. From importations of infected cattle the lung disease attacked the stock on a few farms scattered through the provinces of Drenthe, Groningen, and Overyssel.

It was as late as 1842 that we hear of the first appearance of the disease in Friesland, and its manifestation in the British Isles.

Friesland was free until the British trade was established. In 1842 great ravages in the northern provinces. Diseased cattle slaughtered.

It must be particularly noticed that Friesland, where such havoc has been since committed, was free until the British ports were opened to foreign stock. In 1842 the northern provinces of the Netherlands began to be impregnated with pleuro-pneumonia. The first traces of pleuro-pneumonia were observed at Nejiga and at Wurms. The Dutch Government ordered the slaughter of all the infected cattle, and Friesland remained quite free until 1845. Then our trade with the north of Holland was increasing. Cattle was passing to Harlingen from Overyssel, and in the month of December 1845, the lung disease appeared at St. Nicolunsga, the following March at Mirus, and soon after at Enkhuysen.

Cattle trade too active to render slaughtering effectual.

Prevention by slaughtering diseased cattle was enforced. the authorities in Overyssel were asked to adopt similar measures that there should be no renewed introduction of disease from that province. The cattle trade, however, was too active for this. No sooner was the disease extinguished in one spot then it appeared in many others.

14,000 stables in Friesland been infected.

Mortality in Friesland 40 per thousand head.

In the last half of the year 1847 the disease broke out in 16 stables in 16 different districts. A last attempt was made to arrest the malady, and 703 sick or suspected animals were killed and buried. Larger and larger did the number of infected stables become as the cattle dealers' movements increased. In 1848, 58 different outbreaks occurred. By this time (1863) between 5,000 and 6,000 of the 14,000 stables in which cattle are kept in Friesland have been visited by the disease, and the annual mortality has risen from 5·25 per thousand in 1850 to nearly 40 per thousand at the present time.

Appearance in the British isles.

Let us now turn to our own country.*

It has been asserted that pleuro-pneumonia appeared in this country before, though only very shortly before, our importations in 1842.†

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* I have for a considerable time made it a special point to obtain accurate data as to the first appearance of pleuro-pneumonia amongst our cattle.

It was, as usual in other countries, preceded by the foot and mouth disease, and this depended on the fact that the maladies are communicated in the same way in the lines of communication established by trade; but epizootic aphtha is much more quickly communicated from animal to animal, and herd to herd, than any other contagious disorder we are acquainted with. Spanish oxen imported quite healthy, and exposed in the market at Islington for sale one Monday, are observed to suffer severely from the disease the following week. They come here quite healthy from a country where there is no such disease, and they are forthwith seized. Pleuro-pneumonia is not so rapid, and it is a matter of daily observation on farms and in dairies, that a new purchase communicates the foot and mouth disease, and six weeks later, shows signs of pleuro-pneumonia.

The foot and mouth disease did not precede the appearance of pleuro-pneumonia in America or our Australian colonies, inasmuch as any cattle embarked in Europe would have passed through the different stages of epizootic aphtha on board ship, but would probably show little signs of the lung disease until after the sea voyage, when the period of incubation would have been completed.

† The same assertion has been made with regard to vesicular murrain, and requires he same correction as that which I have made in my text.

IV. Cattle diseases in relation to supply of meat and milk. By Mr. Gamgee.

Undoubtedly it did appear before the *free* admission of foreign cattle into our ports, and singularly enough it appeared in a part of the United Kingdom most distant from contaminated countries, with which our free trade was first opened up, but very careful inquiries have convinced me that it was in county Cork, and indeed in the city of Cork or its vicinity, that the first outbreak occurred. In 1839, 1840, or 1841, animals were imported by gentlemen related to a British Consul at one of the Dutch ports; they were destined for breeding purposes, and at the present day traces of these early importations are to be seen in county Cork, where there are numerous crosses, with a decided admixture of Dutch blood.

Appearance of lung disease & vesicular murrain before free trade in cattle. First outbreak in Cork.

Pleuro-pneumonia was introduced into county Limerick from Cork only in 1844. From Limerick it spread to Carlow, Kilkenny, Tipperary, Waterford, Wicklow, Meath, Galway, and Roscommon.

Pleuro-pneumonia in Limerick in 1844, and further spread.

The losses in Ireland have been enormous, and indeed much larger than in England or Scotland. That this is a fact is proved by the difficulty insurance companies had in keeping any business together in that country. They were obliged repeatedly to relinquish the insurance of cattle to save themselves from early ruin. The north of Ireland has generally been more free from the disease than the south, but we find that in 1844 some cattle were imported into county Tyrone from Glasgow, and amongst those it broke out, continuing its destructive career until 1852, since which it has much abated. Londonderry suffered about 1849–50, and here and there in all the other counties, not excluding Kerry, the introduction of the disease by travelling or purchased cattle has occurred.

Pleuro-pneumonia in North of Ireland.

Imported from Glasgow.

Whilst the lung disease was thus lighting up in different parts of Ireland, it was committing great ravages in England. All the large towns containing dairy cows suffered. Speedily did the disease pass from London to Manchester, and Birmingham to Liverpool, Leeds, Sheffield, and Newcastle. It was in the month of November 1843, that English cattle carried the disease into Scotland. It speedily passed to Glasgow, Perth, and Aberdeen. In 1844 it reached Inverness by cattle taken there by sea. Thus the large towns and their vicinities were first affected, but no great interval elapsed before farms were contaminated. The counties of Norfolk, Lincolnshire, Derbyshire, Lancashire, Yorkshire, and Northumberland were all affected by 1844 and 1845. It was later that the disease entered the breeding districts of Gloucestershire, Herefordshire, and Devon. Cheshire, lost early and much. In Scotland it was 1846 and 1847 before many districts in such counties as Lanarkshire and Ayrshire had the disease. It has committed great ravages in Wigtownshire, Renfrew, Fife, Perth, Kincardineshire, and Aberdeen. It has been rarely, and on few farms in such counties as Argyll, Banff, Inverness, and Caithness. In some of the Scotch Isles it has yet to enter.

Spread of the lung disease in England.

Appearance in Scotland in 1843.

The total absence of statistical information on this important subject is much to be deplored. It is certain that many districts are wrongly supposed to be healthy, farmers preserving the greatest secresy as to losses, in order that they may still be able to dispose of cattle. Our large towns with their thousands of fine dairy cattle stand first on the list as to the prevalence of pleuro-pneumonia; next are the grazing and stall-feeding districts and counties; and the healthiest portions of England, Scotland, and Ireland are those where animals are bred. All this demonstrates that in proportion as purchases have to be made disease is rife. It is absent where there are no buyers, and where all are sellers.

Absence of reliable statistics on the subject.

No decrease in districts where cattle are only exported.

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Dutch cattle cannot be relied on for store purposes.

Serious losses by disease amongst Dutch cattle in this country.

In connexion with the history of pleuro-pneumonia in Great Britain and Ireland, it is interesting to observe that whereas at first people thought they could get store cattle from Holland, they soon found that the losses were too heavy and English stock must be relied on. All who have bought Dutch cattle for dairy purposes, grazing, or stall-feeding have had at one time or other serious cause to regret it. The temptation was great in consequence of the quality of the stock, but the risk too large. On this subject Mr. Robert Herbert says * that experiments "made in fattening foreign beasts in this country, where "successful, have turned out some extraordinary beasts; and had it "not been for the heavy losses by disease, very large profits would "have been realized by our graziers. We may give an instance of an "experiment in Norfolk. An eminent grazier, residing in the country, "purchased in the early part of last year (1858) 200 beasts "in London at 13*l.* each. They were grazed upon strong land and "afterwards stall-fed. After the lapse of five months, about one "hundred of them were again disposed of in the London market at "25*l.* each; but out of the number originally purchased, nearly 50 of "them died, and the remainder produced no profit to the owner upon "the original outlay." The Roxburghshire farmers can relate similar facts, and our dairymen can testify to the enormous danger of placing Dutch cattle amongst healthy stock.

Roxburghshire farmers have expensive loss in the same way.

Pleuro-pneumonia in Sweden and in Denmark. Observations by Mr. Fenger.

I must now devote some attention to the spread of disease from England to other countries, and from Europe to the opposite hemisphere. In 1847 English cattle communicated pleuro-pneumonia to Sweden, and in 1848 it spread from Sweden to Denmark. Mr. R. Fenger, an extremely intelligent Danish veterinarian, writes me as follows:—"As to the appearance of this disease in the kingdom of "Denmark, it is an established fact that it has taken place only three "times upon three different farms where cattle had been introduced "from abroad. No other cattle were affected than those in the three "herds alluded to, and for three years no disease has appeared in "Denmark. As to the spontaneous origin of pleuro-pneumonia, I "wish to draw your attention to the fact that it is never seen in the "town of Copenhagen, notwithstanding that in this place large dairies "are kept where the cows are fed on draff from the distilleries, and "are kept in a state very contrary to any which sanitary rules might "suggest. In the dukedom of Schleswig the disease has been imported (last from England) several times, and occasionally has spread "rather widely. This autumn the cattle of 30 different places in "Schleswig have been kept in a kind of quarantine."

Disease in Oldenburgh.

In 1858 an agricultural society in Oldenburgh purchased some Ayrshire cattle to distribute amongst its members for breeding purposes. Wherever these animals went they communicated disease. Oldenburgh has kept very free from pleuro-pneumonia from the activity with which the infected animals are destroyed on the outbreak of disease. The same remark applies to Mecklenburg Schwerin and Schleswig Holstein. With regard to the latter province, we find that in 1859 some Ayrshire cattle imported in the vicinity of Tondern communicated the pleuro-pneumonia.

Spread to Norway from Scotland.

In the month of August 1860 an agent sent by the Norwegian Government purchased a number of Ayrshire cattle; they were taken to the Royal Agricultural College at Aas, and in the commencement of November pleuro-pneumonia broke out amongst them. Dr. Oluf

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* Journal of Royal Agricultural Society of England, No. xliv., 1859.

Thesen has informed me that he limited the disease to the college by destroying the native cattle with which the Ayrshire stock had come in contact, and keeping the Ayrshire animals to themselves. Norway had been exempt from this cattle plague, and owing to Professor Thesen's activity now enjoys the same immunity.

Communication of the disease from England to America in 1847. Spread to America in 1850 from an English cow. In 1859 from Dutch cows.

In 1847 Mr. Thomas Richardson of New Jersey imported some cattle from England. They soon showed signs of the disease, and Mr. Richardson had his whole stock, amounting in value to 10,000 dollars, immediately destroyed. As early as 1850 a cow which was sold in Brooklyn, N.Y., and which had been taken over to America from England, manifested symptoms of pleuro-pneumonia; she was placed in a herd of 40, and they all died. The disease spread with great rapidity. On the 23rd May 1859 Mr. Wenthrop W. Chenery of Belmont, six miles from Boston, imported four cows from Holland. One cow died as early as the 31st of May, the second on the 2nd of June, and a third on the 30th of the same month, the fourth cow survived; but in the month of June Mr. Chenery sold three Dutch calves to Mr. Stoddart of North Brookfield. Thence the disease spread with great rapidity.

Pleuro-pneumonia imported into Australia from England.

Spread of the disease from Old to New World unquestionably demonstrates contagion.

Within the last three years great ravages have been committed by pleuro-pneumonia in Australia. In the month of September 1858 a Mr. Boodle, farmer, near Melbourne, imported a cow from England; she landed in good condition, and gave milk. She died of pleuro-pneumonia six weeks after her arrival. Two other head of cattle belonging to Mr. Boodle died in December and another in January. The disease continued to spread, and the losses have been enormous and incessant since in Victoria, and the disease has been communicated to New South Wales. Thus, when we trace the history of pleuro-pneunomia, its progress by contagion is proved. Wherever the first diseased animals have been slaughtered early, as in Denmark, Oldenburg, and in New Jersey, the disease has not spread; but where months have elapsed before measures have been adopted, the disease has insinuated itself into many parts of the country and has proved most destructive.

Separate invasions in districts, &c.

2. The contagious nature of the lung plague is also proved by the course which it takes in spreading, and by the singular exemption of breeding districts. The malady on making its appearance does not, as if it were due to atmospheric agencies, to changes of weather, &c., devastate the whole district. A farmer buys a cow, or a lot of cattle, in a public market; in six weeks or two months the symptoms of pleuro-pneumonia appear, but if there are no means of communication between the cattle of this and adjoining farms all the latter remain free, while the entire stock of the former is destroyed. Cases of this description are of every-day occurrence, but I may be permitted to repeat some striking instances where farms that have had the lung disease are in many cases encircled by farms that have escaped it.

First, I would refer to the experience of 26 farmers on one Perthshire estate, that of Lord Willoughby d'Eresby.*

Mr. David Duncan, Mains of Cargill.—The farm has been tenanted by Mr. Duncan's family for 70 years. Pleuro-pneumonia was never seen on it until this year (1862). Mr. Duncan purchased a cow about the middle of December 1861. A month after she indicated the symptoms of lung disease, and was placed under treatment. Two cows were seized a month after this, then other

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* For the interesting details given under this head, I am indebted to one of my students, Mr. Robert Morton, Stobhall Mains, Perthshire, who was most diligent in prosecuting an inquiry which I deemed of great importance for this Report.

two and two two-year olds, until 16 cases occurred. Two were permitted to die, four recovered, and all the other sick animals were sent to Glasgow market. Mr. Duncan disposed of his whole stock, that he might sustain no further loss than was entailed by such a procedure.

Mr. James Mailler, Links.—Had the lung disease 12 years ago, in consequence of purchasing a cow in the Perth market. Again, six years ago he suffered from an attack in a very singular manner. He sent some fat stock to the Edinburgh market, for which he was offered an insufficient price and took it home again. The cattle exposed in the market were seized with pleuro-pneumonia on their return. Since then Mr. Mailler has avoided markets by rearing his own stock, and has sustained no more losses from contagious diseases. Mr. Mailler has been on the Links farm for 30 years.

Mr. William Scott, Balahomie.—Bought stock in a public market 12 years ago, and sustained serious losses by pleuro-pneumonia in consequence. Since then he has reared his own stock; but this season his cattle came in contact with some diseased animals at grass, and he has again been a serious sufferer.

Mr. Jeffrey Greg, Brunty.—Three years ago Mr. Greg let a grass park to an individual who turned some diseased animals into it. The field was only separated from an adjoining park by a hedge, and Mr. Greg's lean stock having thus ready means of approach with the sick animals, was seized with the lung disease, and the farm has never been quite cleared of it since.

Mr. James Adam, Whiteby.—Nine years ago he purchased stock at a public sale, and suffered severely from pleuro-pneumonia in consequence. He has since reared his entire stock, and has sustained no further loss.

Mr. John M'Intosh, Wellses.—The diseased stock of a neighbouring farm broke in amongst Mr. M'Intosh's cattle four years ago. This led to an outbreak of pleuro-pneumonia, which lasted some months. Has been quite healthy since, as he breeds all his stock. Mr. M'Intosh has been 20 years on this farm.

Mr. George Croket, Newmill.—Had pleuro-pneumonia amongst his cattle seven years ago. He rears his own stock. Cannot account for the outbreak, except from the circumstance of the field in which his cattle were grazing at the time being at the side of the public road, along which diseased cattle are often driven.

Mr. John Bannerman, Parkhead.—Five years ago Mr. Bannerman sent some of his stock to be grazed on a distant farm, and diseased cattle happened to be on the field. He sustained a heavy loss. He breeds, and has been 19 years on his farm.

Mr. James Irvine, Newbigging.—Mr. Irvine breeds, but five years since his stock came in contact with some diseased animals that were driven on the public road, and the lung disease soon manifested itself with all its virulence. Mr. Irvine has been 30 years on his farm.

Mr. William Henderson, Lestin.—Has been on his farm 12 years. He is constantly buying in the public markets. The lung disease first broke out five years ago. Has continued more or less ever since.

Mr. Alexander Rutherford, Campsie.—Had an outbreak of pleuro-pneumonia on his home-bred stock five years ago. He attributes it to contact with diseased cattle on the public road.

Mr. Peter M'Gregor, Wolfhill.—Never had the disease. Breeds his own stock.
Mr. James Marshall, Knowehead.—Ditto.
Mr. John Howie, Moreside.—Ditto.
Mr. David Cardean, Hatton.—Ditto.
Mr. Alexander Ritchie, Whitefield.—Ditto.
Mr. John Miller, Gallowhill.—Ditto.
Mr. John M'Kenzie, Gallowhill.—Ditto.
Mr. James M'Beath, Stobhall.—Ditto.
Mr. Thomas Simpson, Whitefield.—Ditto.
Mr. James M'Farlane, East Whitefield.—Ditto.
Mr. Thomas Fullerton, Redstone.—Ditto.
Mr. Thomas Thomson, Springfield.—Ditto.
Mr. David Meal, New Mill.—Ditto.
Mr. Peter Blair, Mid Whitefield.—Ditto.
Mr. John Morton, Mains of Stobhall.—Ditto.

IV. Cattle diseases in relation to supply of meat and milk. By Mr. Gamgee.

Another* illustration which I may adduce is that of the parish of St. Martin's, in the county of Perth. Pleuro-pneumonia first appeared in the parish in 1845. Since then 10 farms have been visited by the disease, and in every case the attack has been distinctly traced to contact with diseased cattle. Nineteen farms have enjoyed a perfect immunity, as they are all breeding farms, and purchases are very rarely made.

Again, a wide district around Abington and Crawfordjohn in Lanarkshire is entirely free from pleuro-pneumonia; and one of my most intelligent students, Mr. David Menzies, of Bellfield, wrote to me recently in the following terms:—"Pleuro-pneumonia is extinct in " this district and has been so for the last two years. It has only " appeared in three or four instances, and in all was distinctly traced " to contact with diseased animals. Our total immunity from it, as " well as other infectious diseases, is due to the great care taken by " farmers to prevent their introduction. Each stockowner does his " utmost for his own interest, and the whole act together for the " common good." It is a breeding district. If winds and wet and other general influences induced the outbreak of pleuro-pneumonia, how could it be that in the county of Lanark we have all the upland breeding districts healthy, while in and around Glasgow the mortality is always at the very highest point? or how could it be that in Renfrewshire districts which do not suffer are seen side by side with districts which suffer, perhaps, the highest loss yet recorded from pleuro-pneumonia? the Paisley district being constantly the seat of outbreaks, while districts around remain perfectly healthy.

I have purposely chosen the examples of counties, estates, entire parishes, extensive districts, and individual farms to indicate the singular features of the outbreaks of the lung plague; and if it were deemed necessary I could, in a short time, collect very accurate information to the same effect concerning many other parishes and estates. But from the facts adduced it is evident that home-bred stock, unless coming in contact with diseased stock, is not affected with pleuro-pneumonia; that the disease disappears from the country, county, island, or farm if purchases are discontinued; that the outbreaks on an estate occur on individual farms at irregular intervals, according to the times at which purchases are made or other contact with diseased stock occurs.†

Facts relating to the prevalence of pleuro-pneumonia in large towns.

3. The contagiousness of pleuro-pneumonia may be further illustrated by facts relating to its constant prevalence in large towns. I have usually considered that every third cow in a town dairy dies or is slaughtered because affected by the disease, and very often the severe attacks amount to 60 and 70 per cent. In the statistical chapter of this report very singular and alarming revelations appear concerning

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* For the facts relating to the parish of St. Martin I am specially indebted to my student, Mr. Patrick Mackenzie.

† Dr. Headlam Greenhow says, in referring to his inquiries as to the contagious nature of pleuro-pneumonia: "'All my informants concurred in asserting that ani" mals which have been recently purchased or removed are more liable to suffer from " pulmonary murrain than such as have been some time in the sheds." This statement evidently indicates the connexion of the disease with traffic. Thus, although pleuro-pneumonia has been in this country for 20 years, it first broke out on Lord Willoughby D'Eresby's estate about 18 years ago. The exact date cannot be had, as the farmer who first suffered is dead. Some farms have escaped altogether. The outbreaks on others have been due to causes totally distinct in each case. Two occurred 12 years ago, one nine, another seven, another six, four five, one four, one three, and two this year (1862).

IV. Cattle diseases in relation to supply of meat and milk. By Mr. Gamgee.

Edinburgh; yet Edinburgh is certainly not worse than other large towns, as the stock purchased is excellent, and the cowsheds bear comparison with those of other cities. It is certain that bad ventilation, filth, changeable weather, feeding on distillery wash are incapable of producing pleuro-pneumonia. The cause of its origin and existence in town dairies was and is the purchase of infected cows. Cow feeders must be constantly purchasing, and we find the disease kept in check by those who buy only from farmers whose stocks are healthy, and by those who keep cows in fields for two months before taking them into town, and thus satisfy themselves that the animals are not diseased. Our large city markets, teeming with infected cattle, are hot-beds for contagious disorders which destroy the best of our farm stock.

Experimental inquiry as to the contagious nature of pleuro-pneumonia.

4. To the same effect are the results of an experimental inquiry which was made in France by a scientific commission under the presidency of Magendie, and the report of which was published in 1854. The results were as follows: That epizootic pleuro-pneumonia is susceptible of being transmitted by cohabitation from diseased to healthy animals; that not all the healthy animals take the disease, but that some escape and others suffer slightly; that of the affected animals some recover and others die; that the affected animals, whether slightly or severely affected, are after recovery insusceptible of any second attack of the same disease.

As to the proportions in which exposed animals escape or contract the infection, and as to the proportions of death and recovery among the infected animals, the experiments were not numerous enough to justify general conclusions, and therefore with reference to these questions the commissioners simply stated the results of the experiments, viz., that of the exposed animals per cent., 66 contracted the disease (45 severely, 21 slightly), while 34 remain unaffected; and that among the affected animals the mortality was 17 per cent.

Results of the author's experience as to preventive measures.

5. Equally conclusive as to the contagiousness of the disease are the results of my own experience as to the means which check its progress. I am frequently consulted as to the prevention of pleuro-pneumonia, and invariably act on the belief of the disease existing only as the result of contagion. Thus, I have been called to stocks where proper ventilation had been carried out, where the cattle had been kept in the most cleanly condition, where disinfectants had often been used, and in several instances old buildings been demolished to make place for new ones in the hope that these would prove healthier; but I have found that those who have relied on such measures for the prevention of pleuro-pneumonia have met with disappointment.

In cases where the extent of stock has been small I have suggested that it should all be slaughtered and that the purchase of new stock should be made in healthy districts. This, in all cases where it has been done, has put a stop to the disease.

A second plan I have adopted with farmers has been to recommend them to breed all their own stock, and to buy what they absolutely need from stocks known to be healthy. Persons who had lost heavily for many years in succession prior to following this advice, have since, for several years, remained quite free from disease.

Where it is impossible to carry out the plans above suggested, I have carefully examined the old stock, separated all doubtful cases, and supported the healthy with tonics and a liberal diet. This plan has succeeded admirably in my hands. But it must be remembered that for it to be effectual each examination must aim at detecting the

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disease in its earliest stage, and must therefore include very careful auscultation of the lungs.

On one or other of the above plans, I always succeed in putting a stop to the spread of pleuro-pneumonia. And the principle of all the plans is to deal with the disease as contagious.

Corroborative quotations from other authors as to its contagiousness.

6. The arguments which I have adduced in proof of the contagiousness of the disease rest not alone on my own observations, but on the best authenticated experience of other members of my profession. It is true that from the earliest times some veterinary surgeons have declared themselves non-contagionists, but their doctrine has not been, in my opinion, even plausibly supported by their facts. Some ascribe the disease to bad ventilation and filth ; but were our dairies and farms before 1842 better than they are at present ? Or is it bad ventilation that induces the disease in the hills ? Others attribute much to the east wind ; but has not the plague been rife in the most beautifully sheltered lowland pastures ? And had we not east winds before the 9th July 1842. Others, in professing to denote the causes of the disease, use that very general expression "epizootic influence," and rest satisfied with it as an explanation. Non-contagionists, few in number, assert, indeed, that it often appears where no purchases have been made ; that home-bred animals have died where purchased stock had remained healthy ; and generally that part of a stock enjoys immunity, while others fall sick with the disease. Now, wherever I have had a chance of inquiring closely into the cases when it has been said that no purchases have been made, I have usually found either that this statement has been incorrect, or else that farm-steadings and fields have been in the road side. In not a few instances I have ascertained that diseased cattle had been turned into pastures at night or had travelled over the farm by day.

Again, as regards the alleged healthy state of stock communicating the disease, it has not been sufficiently remembered that an animal which eats, yields milk, and thrives, may be convalescent, and may have considerable latent disease ; perhaps even one lung adherent and in great part hepatized.

As to the exemption of part of an infected herd, this is fortunately the case with all the most fatal diseases ; but my previous quotations from the report of the French commission on pleuro-pneumonia has shown that in this disease the escapes are much less numerous than non-contagionists have believed.

On the other hand, the advocates for the contagiousness of pleuro-pneumonia are very numerous. Some think, however, that the disease may *possibly*, under certain influences, originate spontaneously, even in Belgium, Holland, or the United Kingdom ; while others (like Haller and Layard) make no such concessions to the non-contagionists, and some of these have been converts from non-contagionism.*

Delafond's work leaves no doubt on the subject. "Contagion," he says, "has particularly fixed my attention, and it has been for me the

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* Professor Fuchs has published a long list of the advocates in favour of contagion, which includes Chabert, Tscheulin, Luppe, Sander, Ernst, Laurin, Kündig, Wirth, Frey, Vix, Gartellier, Toggia, Schneider, Niemann, Veith, Schrader, Prinz, Rychner, Hering, Hertwig, Gerlach, Van Hertum, and many more. Not a few have been converts from non-contagionism. Wagenfeld says : "In a paper of mine which I published 10 years ago, I expressed my opinion positively against the view that the "lung disease was contagious. Now, after making numerous new observations on "the lung plague, and subjecting the same to an unbiassed critical examination, I "find myself constrained to admit that my earlier views were erroneous—the lung "disease is very contagious." The same change of opinion occurred with Professor Spinola, of Berlin.

Delafond on the sale of diseased cattle.

“ object of long and laborious researches. Admitted by some and rejected by others, it was of great importance for me to elucidate this question ; it occupies, therefore, a great portion of my work. To convince my readers that the pleuro-pneunomia of cattle was really a disease communicated by mediate and immediate contact between healthy and diseased animals, whether in the stable or fields, in neighbouring pastures, or when condemned to breathe the emanations derived from cadaveric remnants, I have stated 79 cases, including 505 transmissions of this disease. It has not sufficed that I should demonstrate by this mass of facts that pleuro-pneumonia should be classed amongst the contagious diseases ; I have also wished to prove that the facts supported against contagion by French and foreign veterinarians, whose talent and learning I much respect, were not accompanied by those circumstantial details which are required by persons who desire to be convinced on such a delicate and important question as the one under consideration.* . . . It results from the information I have collected at Bray, and from that received from veterinary surgeons worthy of confidence, who practise in Picardy, Flanders, Pas de Calais, Pays de Caux, and in the environs of Paris, that as soon as pleuro-pneumonia enters a stable, the proprietors hasten to sell the animals, in consequence of the incurable nature of the malady. They sell, if fat enough, to the butcher, otherwise they dispose of the infected animals (bêtes contagionées) which would have the disease later, to the merchants, who take them to fairs and markets. Now what occurs from this perfidious sale ? that the infected animals, and even sick ones, carry the disease into the stables of those who have bought them; so that if in the infected stable there are 40 animals, for instance, and if 10 of these, being sold, become ill in 10 stables, the latter may all be infected and suffering ; thus, the proprietors of the 10 new foci of contagion (foyers de contagion) also sell their animals ; from 25 to 30 stables are thus invaded by the disease. Thus, I can state pleuro-pneumonia spreads and multiplies its foci of contagion.”

The careful perusal of Delafond's work, and especially of his résumé, indicates that he did not believe in the spontaneous development of the lung plague in France.

Sauberg, the author of a most erudite prize essay on the present subject,† speaks of pleuro-pneumonia as a peculiar contagious disease which only attacks cattle ; he cannot suppose that hurtful atmospheric influences would affect only cattle in a specific manner without inducing analogous diseases in men and amongst other domestic animals ; and he speaks of the non-contagionists' accusations against “atmospheric influences” as being mere cloaks for ignorance.

Gerlach's opinion.

Professor Gerlach, now director of the Veterinary School at Hanover, who holds a high reputation as a man of great practical experience as well as learning, has made the subject of contagious diseases one of special study. He has found, as I have myself, that a conscientious investigation of any outbreak does not fail to determine in all cases that healthy stock has been contaminated by diseased animals. And it is in consequence of this that he expresses himself in the following peculiar terms : “Diese meine eigenen Erfahrunggen haben mir in verein mit den geschichtlichen Katatsachen eine solche sichere ueberzeugung gegeben, dasz ich nich nöthig habe, noch eine

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* Traité sur la Maladie de Poitrine du Gros Bétail connue sous le nom de Péripneumonie Contagieuse, par O. Delafond. Paris, 1844.

† “Die Lungenseuche des Rindviehes und ihre Geschichte besonders in Rhein “ preussen und Holland seit dem Jahre 1830.”

“ Hinterthür zum etwaigen Ruckzuge offen zu halten, und in dieser sichern ueberzeugung habe ich est stets für meine dringendste Pflicht gehalten den Glauben an selbstenwickelung durch rede und schrift zu bekämpfen, weit er der seuche vorschah giebt under dir wichtigste Hemmshuh ist dieselbe zu tilgen. Sund erst die staats behörden und Landwrithe allgemein von der wahrheit überzeugt worden dann hat die Lungenseuche ihre macht, ihre Gemeingefahr verloren, und dazu beizutragen, ist ein Hamptzweck, den ich bei diesem vortrage in Auge habe.”

Mr. Waters on communication of the disease.

Mr. Waters, whose prize essay on the subject of pleuro-pneumonia has attracted some attention, says, in his most recent publication,* “ A reference to our cases will, we think, satisfactorily show that it, the pleuro-pneumonia, is chiefly due to the introduction of drifted cattle to home stock . . . the disorder is principally propagated by fairs and markets.”

Dr. Warneke's, of Kiel, views.

Dr. Warneke of Kiel, in a paper translated by Dr. Headlam Greenhow, says, “ It becomes every day more evident in this country that the pulmonary disease is not indigenous here ; that it has not developed itself spontaneously here, but that it owes its presence entirely to contagion arising from the importation of foreign cattle.”

Opinions of Mr. Hansen.

Mr. Hansen, veterinary surgeon, in a report inclosed in Mr. Vice-Consul Bird's dispatch from Hensborg of April 6th, 1857, and also published by Dr. Greenhow, says, “ The lung disease is contagious, *i.e.*, it developes a contagious principle ;” in Schleswig it can be “ clearly shown by facts that the disease has always been introduced here from abroad, viâ Hamburgh or Altona, and then propagated by occasional cases of infection. This is proved by its having first shown itself near Altona, and by its gradual extension towards the north, by its repeated suppressions [stringent regulations, and slaughtering the diseased animals, J. G.] and subsequent reappearance from the same quarter ; and by its appearing principally in those districts where an active cattle trade exists.”

The length to which I have extended this analysis of facts and opinions in order to demonstrate the real cause of the lung plague of cattle in this country precludes my saying much more on the subject, though many further observations and statements might have been included under each head.

Careful inquiries of the supporters of contagion.

I must, however, observe that such men as Delafond, Sauberg, Spinola, Wagenfeld, Gerlach, and many more have given evidence in their writings of a very careful study of the whole question, of laborious inquiries, and often of conviction against preconceived ideas.

b. Epizootic aphtha.

Outbreaks of the disease.

Outbreaks of this malady have been recorded during the last 200 years. It is more especially in the 18th century, however, that observers described with any accuracy the course of the disease, its symptoms and prevention. It is no exception to the general rule of cattle plagues. Its progress is from east to west. We find Poland importing it from Russia, Prussia from Poland, Austria through Hungary, and Switzerland invariably from the Austrian States. Spain and the West of France have enjoyed their usual immunity, and no instance of the foot and mouth disease ever occurred in the British Isles before 1839. At that period the disease was prevailing to a greater extent than had ever been known before across the Irish Channel and German

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* Pleuro-pneumonia in Cattle ; its natural Causes and Cure. By George Waters, 1860.

IV. Cattle diseases in relation to supply of meat and milk. By Mr. Gamgee.

Ocean. It appeared almost simultaneously in London and Cork, owing to importations of cattle, and then spread as usual with greater rapidity and certainty than all other plagues. Both the rapidity and certainty of the spread of this disorder are due to its attacking all warm-blooded animals, man not excepted, and its incubative stage being shorter than that of any other contagious disease. The contagious principle is discharged by diseased animals in very large quantities with the saliva, and from the eruptions on the teats and feet. The milk of animals affected is highly charged with it as a rule, but probably only when vesicles exist on the teats, and their contents are discharged as the milk is drawn. I have witnessed outbreaks of the disease due to susceptible animals following diseased ones on a road; to a dairymaid having been employed to milk cows at a distance from a diseased herd, which she milked daily; to green food carted from fields where affected animals were calved; or placing healthy with diseased on the same pasture. By far the most common and constant means operating in favour of an extension of the disease consist in placing cattle, sheep, or pigs in railway trucks into which diseased animals have previously been, and exposing healthy with diseased in the public market.

Attacks all warm-blooded animals.

Communicated by railway trucks.

It is also certain that epizootic aphtha spreads from place to place owing to game, especially hares and rabbits, by affected.

Satisfactory character of the reports of the early appearance of this disease in England. Statement by Mr. Karkeek of Truro.

The earliest records of the disease in England are very satisfactory and contain much useful information. The contagious nature of the disorder could not help striking every one, and we have the most conclusive proof, that in some of the most remote counties it was carried by diseased animals. Thus, Mr. W. F. Karkeek, of Truro in Cornwall, writing in February 1841, says, "Previous to the 1st of December, I " believe that I am correct in stating that we had not a single case in " my district. There may have been some few in the neighbourhood " bordering on Devonshire, but I never heard of any.

" On the 1st of December there was a fair of cattle held at St. Austle, " to which several cattle were brought, either from Devon or Somerset, " for sale. These were chiefly purchased by a few farmers, and in " about three or four days at the utmost this epidemic was observed on " each of the farms to which these strange cattle had been taken. " Other cattle that were exposed for sale, and that stood alongside of " the eastern cattle in the fair, showed symptoms of the disease also " about the same time, so that in the course of one week after the fair " alluded to the disease had rapidly spread, but still was confined " to the cattle on the different farms to which it first was carried.

" Notwithstanding that the utmost precaution was taken by the " farmers to prevent this disease from spreading by prohibiting all " persons that had any communication with infected places from visiting " their farm-yards, before the latter part of the month (December) " other places became diseased; and in every instance, that I know of, " it never ceased until nearly the whole of the cattle, sheep, and pigs " in the place were infected. There were three very clear cases, for " the truth of which I can vouch, in which the disease was carried to " the adjoining farms by their owners visiting their neighbours' infected " cattle, and the going immediately home, and examining their own " stock to see if they were still free from the calamity. In one " instance of this kind the distance of three miles existed between the " farms."

Conclusion.

As usual, many causes have been assigned for the disease, but the most careful investigation into the history of all outbreaks in Great Britain indicates, as the foregoing references show, that the malady *is invariably introduced here, and spreads exclusively by contagion.* There is not a single satisfactory instance recorded of a spontaneous development in the United Kingdom.

c. Small-pox in Sheep; its history and causes.

The malady is both contagious and infectious.

Small-pox in sheep spreads both through contagion and infection. Observers are agreed that it is not safe for a healthy flock to come to within 500 yards of a diseased one. A fixed virus is deposited in stables, on pastures, roads, railway trucks, &c., by diseased sheep, and many agents may thus act in favouring an indirect contact. Human beings carry the disease for miles, and shepherds have often communicated the malady to distant flocks. It is said that hares and rabbits are subject to the disorder, and may be the carriers of the contagion. Sheep dogs certainly can be the means of transmitting the virus. The malady has been observed on them, and a marked case occurred in Wiltshire. Mr. Charles Percivall had an opportunity of observing the disease on Mr. Stephen Neate's dog, and informs me that the symptoms were identical with those of variola ovina, and there could be no doubt that the dog contracted the disorder from the diseased sheep. The disease has been communicated by inoculation to man and cattle.

Tendency of the disease to spread in a flock.

When small-pox enters a flock it may be checked and limited to a few cases, or it may affect the whole. I have observed that the disease is far more severe in countries where it is the practice to house the sheep. Few escape and the majority die. It is this that renders all the German veterinarians such decided partizans of the practice of inoculation. They find that sometimes not one per cent. die where flocks are inoculated, whereas 50, 60, 80, and upwards of 90 per cent. are destroyed by the natural disease.

Mortality heavy in confined places.

In proportion to the close, hot, and ill-ventilated condition of stables in which sheep are congregated is the mortality heavy. The malady spreads far more certainly and rapidly amongst the continental flocks than our own. Here the course of the disease usually consists in the attack of one or two animals which probably survive, but not being separated from the flock contaminate dozens. In the course of about a month several score of sheep are affected, and in two, three, or four months every member of a flock of one or two thousand sheep may have been seized. Where a flock of sheep is housed the disease is propagated to every animal in as many weeks as it takes months on our hills.

Many vigorous animals in a flock prove rather refractory to the influence of the virus, and some may escape altogether. This is not seen where causes combine to weaken the system and favour the repeated approach of contagious matter.

In France the mortality observed amongst flocks affected with this disease varies from 20 to 40 per cent. In England it has attained 50 per cent.

Causes of small-pox in sheep in Europe.

Every writer of merit in Europe attributes this disease to the introduction of diseased animals across the Russian frontier into Poland, Hungary, Prussia, Pomerania, &c. This malady, like pleuro-pneumonia in cattle, epizootic aphtha, and contagious typhus, spreads *invariably* from east to west. It is a malady which never has, and never will, originate spontaneously in this country.

Kept up in Europe by yearly inoculations.

It is perpetuated in some countries, such as Prussia, and especially in its eastern divisions, by the practice of the yearly inoculation of lambs born on farms frequently visited by the disorder.

Mr. Mayer, writing in 1848, said, with regard to inoculation for small-pox in sheep, "I should myself question its policy, as it tends to "perpetuate a disease in the country which, by sanitary regulations on "the part of the Government and the active co-operation of local "authorities and agriculturists, might be arrested in its course and "thus die out." I shall consider the subject of inoculation further on, but cannot refrain from quoting Mr. Mayer's words, which are pregnant with truth. Europe has lost hundreds of thousands of sheep, and has suffered from repeated outbreaks entirely from the absurd practice of inoculation. It is the most active cause tending to propagate the disorder with rapidity over the greater part of the continent of Europe. Thus, if a flock of infected sheep communicates the disease to one or two districts in Mecklenburgh, the appearance of the disorder is notified to the magistrate, and the districts are proscribed. This is the signal of alarm which leads forthwith to the inoculation of flocks in a number of districts, and for miles around the seat of the first outbreak. The result may readily be conceived; a whole country is at once affected. The inoculated flocks are soon pronounced "through the "disease" "*durchgeseucht;*" and as animals are freely sold from them, we find disease spreading through the convalescent or healthy sheep. It is impossible to say how soon after inoculation or a natural attack a sheep loses the power of communicating the disease. Wool retains scabs and virus in great quantity, and inoculated sheep that have apparently recovered have frequently led to outbreaks of the disorder.

General history of small-pox in sheep.

Heusinger says, with justice, that the epizootics of sheep are rarely well noted by authors, and a history cannot be given of them. I do not intend to trace all the outbreaks concerning which partial information has been obtained. Since the first reliable accounts of this disease in 1567 by Laurent Joubert, there have been a series of more or less general spreads of this disease over the continent of Europe. It is not unlikely, from references by old authors, that on some rare occasions the disease was imported into the British Isles, but there are no satisfactory records of such events; and Hogg, writing in 1807, having given an account of the sheep pox, as described by a French veterinarian, Vitel, observes "that "sundry of the diseases here treated of are analogous to those "in our own country, consequently the cures must also be of use "here; and though others of them have not yet appeared in Britain, "the introduction of foreign breeds may introduce foreign diseases. "This we can neither guard too well against, nor be too well pre-"pared for when it happens."

First appearance in this country in 1847.

Our veterinary surgeons had never seen the disease, except abroad, until 1847. That our insular position protected us formerly there is no doubt, as every 10 or 15 years the flocks of eastern Europe have suffered severely, and since the beginning of the present century there are yearly outbreaks in one country or another. All the information I have been able to obtain indicates that Russia and the countries bordering on it suffer most; Greece has been a very constant sufferer, as well as Austria. More rarely has the disease devastated the flocks of the northern German states, as well as Hanover and Saxony. Holland and Belgium have been occasionally the seats of the disease, and France has suffered more than either, owing to its more extensive importations. For many years past the malady has been stationary in Prussia, attacking many districts yearly from the introduction of diseased sheep, or the practice of yearly inoculations. The disease has travelled thence through Pomerania to Mecklenburgh, and through Hanover to Holland, and Britain has received infected flocks of sheep from Hamburgh,

IV. Cattle diseases in relation to supply of meat and milk. By Mr. Gamgee.

Tonning, and Rotterdam,—far more frequently, I believe, from Hamburgh than from any other part.

Why did small-pox not appear in this country from 1842 to 1847?

It is somewhat remarkable that our flocks should have escaped attacks of small-pox during the first five years which succeeded our importations, but my inquiries in London amongst very well informed dealers, butchers, and others, are satisfactory. The sheep imported were at that time very inferior. They were not like the cattle which communicated pleuro-pneumonia, bought up for store purposes, but sold at once and slaughtered. The London market was then not so common a resort as at present for farmers who purchase sheep to feed for a few months, and at most some butchers might have kept a few over from one week to another, or a little longer. Some of these kept sheep often died, so much so that those who bought them did not repeat the experiment, and lean small sheep were dressed up *as lamb* and sold in the east end of London amongst the poor. Whilst lamb was at a high price in the west end, it was at 4*d.* or 6*d.* a pound where the lean, small, and palid foreign sheep were sold as such.

Appearance in 1847 accounted for by rapid increase in the importations.

But a very satisfactory explanation of the alarming introduction of small-pox in 1847 is to be found in the extraordinarily sudden increase in the importation of sheep. In 1847 139,371 sheep were imported, whereas the total amount for the five years previously was 111,222. The number was as low as 210 in 1843, under 2,000 so late as 1844, under 16,000 in 1845, and 91,732 in 1846. The foreign dealers were exerting themselves to increase the supply of sheep, and it is not at all to be wondered at that small-pox spread westward. It must not be forgotten that the countries with which we immediately trade were as healthy as our own in the early days of our importations, and it was only when they had to import for our supplies that they suffered and injured us.

It was only then as the foreign stock improved in character and increased in quantity that small-pox attacked our flocks. There may have been partial outbreaks, as there have been frequently since 1847, but being confined to a few sheep, and fortunately not spreading, we have heard no more of them.

Outbreaks continue until 1850.

The outbreak of small-pox in 1847 continued until 1850, and it interfered with the foreign trade. It was as late as 1850 that the importation of sheep again attained the number of 1847; indeed, it exceeded that number by nearly 4,000 sheep, and there was a rapid increase in our importations up to 1852. They then attained 217,649, and although individual outbreaks of small-pox had occurred since 1849, especially amongst the stocks of butchers, it was in this year of extraordinary increase in the foreign trade that we began to suffer more severely. More severely still in 1853, and then, thanks to the general practice of slaughtering foreign sheep in or near London, we escaped until 1862. I am assured that during the last three or four years cases of small-pox have been seen by salesmen and butchers who have kept foreign sheep over from week to week. I have also been informed that there have been more foreign sheep, or British sheep that had been mixed with foreign ones in the London market, sold this year to be fed inland, than for many years previously, and that a number of partial outbreaks have come to the knowledge of those whose trade would be destroyed if they did not keep the secret, and who, knowing the dreadful nature of the disease, destroy the infected animals at once. One man purchased a lot of foreign sheep at 30*s.*, and in one week was glad to dispose of them at one-third that sum.

Cause of small-pox in Spain.

Merino sheep imported from Tonning, but most probably reared in Mecklenburgh, were the first to communicate the disease to British stock. Spanish sheep have been reported as frequently attacked with the disease, and the outbreaks in Spain and Portugal are undoubtedly due to communication with Africa across the narrow straits of Gibraltar. But merino sheep are largely fed and reared in those parts of Europe where I have already said the malady rages constantly. It is not to be wondered at then if they communicated the disease to us. Fifty-six of these sheep purchased on the 26th July 1847 led to an outbreak at Datchett, near Windsor. They were imported from Tonning on the coast of Denmark. Another lot of 166 were brought into the port of London from Hamburgh by the "Mountaineer," and one of 80 by the "Princess Royal." A part of a large cargo were purchased on the 26th of July of two salesmen by Mr. B. Weal of Woodhall, Pinner. "These " lots," says Mr. Simonds, " were equally divided between himself and " his brother, and in both of them the disease has shown itself." A portion of the same cargo of sheep by the " Princess Royal " was sold to Mr. Goodchild of Kingsbury, and they are reputed to have been also affected with it.

In 1847, 1848, 1849, and 1850 the disease committed great ravages not only in Middlesex and Surrey, but particularly in Norfolk, Cambridgeshire, Suffolk, and Hampshire.

Since that period, though no information has been obtained of local outbreaks, it is known to practical men that these have not been few.

When we know that the very large majority of outbreaks of pleuropneumonia are concealed, it is natural to infer that the same has happened with outbreaks of small-pox, especially amongst the class of persons who deal in foreign stock, and who know the malady perfectly well.

Abroad I have found that outbreaks are also very generally ignored. The most complete collection of records referring to this as to the epizootics is to be derived from the Mittheilungen aus der thierärztlichen Praxis im Preussichen staate, published June 1854 in Berlin.

Professor Gerlach on small-pox in Prussia.

In 1858 Professor Gerlach stated that statistics indicated the greatest prevalence of the sheep-pox in the principal provinces of Prussia, Posen, Pomerania, and Brandenburg ; in Silesia and Saxony only isolated outbreaks occur, whereas the western provinces have remained free. It is thus evident that the disease is stationary in certain provinces, and the question is, must it be regarded as an enzootic disorder due to local influences, or is the cause of its persistence in these parts the preservation and reproduction of the small-pox virus by means of yearly inoculations as a precautionary measure on the part of many flockmasters ? Some inoculate and others do not, the *contagium* is, therefore, preserved or regenerated at several or many points. Under these circumstances it is scarcely possible, adds Gerlach, to avoid the spread of the disease from the inoculated herds, and this happens with great certainty and frequency in consequence of the absence of all sanitary regulations with regard to the inoculated flocks. Several farms exist in each circle where small-pox appears annually. After soliciting aid from his different reporters in order to collect facts on this subject, Gerlach says that in the Regierungs-Bezierk, Potsdam, in which he had occasion to investigate the outbreaks of the disease, they were always due to contagion. Often they depended on the sheep coming in contact with inoculated flocks, and at other times on sheep imported from Pomerania.

It is therefore evident that the practice of inoculating lambs may be beneficial to farmers in danger of suffering from small-pox amongst their sheep, but these inoculations should be practised on all the animals in a district at once or not at all. This, I need scarcely say, would be as absurd as it would be expensive and difficult. Prussia suffers more from partial yearly inoculation than from the natural outbreaks due to the importation of foreign stock.

I have frequently referred to small-pox in Pomerania. My inquiries when in Germany resulted in the confirmation of all I had previously heard and read as to small-pox in that part of the Prussian dominions. I learnt, however, that in 1861 the disease was worse than it has been for many years, and as usual the alarm of small-pox outbreaks led to many farmers inoculating their flocks, and establishing many centres whence the disease could extend itself.

Contagious diseases in Mecklenburgh.

The year 1862 has been one of extraordinary losses by contagious disorders. From Pomerania the foot and mouth disease entered Mecklenburgh in January, and pleuro-pneumonia also appeared in the Grand Duchy. The government is, however, very active in tracing the infected herds, and the outbreaks of these diseases were comparatively limited, though continuing more or less throughout the year.

Appearance of small-pox at Hinter Ribnitz.

Small-pox in sheep then broke out. It appeared in April at Hinter Ribnitz, and thence it spread to many farms in the neighbourhood of Rostock. The attention of the Mecklenburgh Government was directed to the subject in the month of June. District after district was rapidly proscribed, and many farmers, alarmed at the approach of disease, inoculated their flocks. The extent and distribution of the malady is shown in a map of Mecklenburgh.

My inquiries in Mecklenburgh led me to believe that districts were proscribed long after small-pox had been in them. Though the Government regulations are stringent, there are no means employed to ensure that they are enforced. It will be observed that it was officially announced that small-pox was at Quassel only as late as the 6th of September, whereas by that time the disease had committed great ravages, and had in reality been in a flock four months. Many other cases of a similar nature occurred. I also found that infected sheep and the skins of animals that had died of the disease were sold.

Small-pox at Quassel.

The first farm I visited on my way from Hamburgh to Rostock was Quassel, near Pritzier, towards the south-west of Mecklenburgh Schwerin. The proprietor farms his own land. He is a wealthy man, possessing also an estate on which he has sheep and cattle beyond Lübeck. At Quassel he had in the month of May last 250 sheep. As none are bred on this estate, and only purchased to fatten for the butcher, 400 sheep were bought about the middle of May. The 250 fat ones were then sold, but not removed by the dealer. Both purchase and sale were effected by the proprietor, Herr von Paepke, with a Mr. Reuter, a large dealer in Hagenow. Herr von Paepke could not at the time learn, because Herr Reuter chose to conceal, whence the 400 sheep came, but afterwards was informed that they came from an infected district in the neighbourhood of Gustrow. Very shortly after purchase, disease appeared in the new flock, and spread so rapidly that in July it was thought expedient to clear out the fat ones, which were sent to *Hamburgh for the English trade*. On this point my inquiries have been most particular, and I state the facts as gleaned from Herr von Paepke himself, his land steward, and shepherd. In August all the sheep were inoculated, and with apparent effect. I examined the seat of the inoculation, the ears, in many, and the appearances indicated that the inoculation had taken effect. Many severe cases resulted from the inoculation, and some apparently natural cases occurred, and within the last three weeks a very severe outbreak

Purchase of sheep in May.

Appearance of small-pox.

Sale and removal of sheep for England.

Inoculation practised.

Loss of 145 sheep at Quassel.

Diseased sheep skinned in contravention of the laws.

has been witnessed in which many of the sheep have a well-developed eruption, and others are seized chiefly in the head, and are suffering to a great extent from partial paralysis of the hind quarters. The loss on these 400 sheep has attained the heavy number of 145, and several others are sure to succumb. Not only, however, has Herr von Paepke sold sheep since the disease broke out on his farm, but I noticed in a shed a large number of skins. I was told that these were the 145 skins of the dead sheep, and that such was the fact their appearance amply betokened. It was considered a great pity to bury the sheep with their skins, and the law has been evaded as it is daily in Mecklenburg.

Small-pox at Heidhof and Felklas.

Small-pox was also raging at Heidhof and Felklas, and after inquiries in the south-western district I proceeded to Schwerin. There I found the district clear; some farmers had inoculated, but not in the vicinity of the town.

Small-pox in the Doberan district.

Flock of 900 sheep home-bred.

One natural case.

Inoculated on 15th August. Flock pronounced healthy on 26th September.

Outbreak again on 7th October.

Cause of second outbreak.

Examination of flock indicated that it has been well inoculated.

My visit afterwards to Rostock afforded me an opportunity of spending some time with a gentleman who has been very active during this outbreak, and who did much in 1843, 1844, 1848, &c., when small-pox also existed in Mecklenburgh. This gentleman, Dr. Cohen, is professor of veterinary science in connexion with the Agricultural College. In his company I proceeded to the extreme north of the duchy in the Doberan district, where the disease is raging very severely. On the farm of Hinter Bollhagen, tenanted by an extremely intelligent gentleman, Herr Domainpächter Zander, I witnessed a very singular outbreak. In the month of July last Herr Zander had a home-bred stock of 900 sheep. None were bought, but the district is an open one, and many flocks, as in Wiltshire, travel backwards and forwards. On the 12th of August a natural case of small-pox occurred; a veterinary surgeon was called in, who, in accordance with the laws for the prevention of this disease, inoculated the whole flock on the 15th. Herr Schroeder, of Kreplin, the veterinary surgeon, has the reputation of being very skilful, and he inoculated all the sheep with perfectly fresh lymph, in the tail. A benignant eruption resulted, and in about five weeks the whole flock was pronounced through the disease, and on the 26th of September it was officially announced that the farm was clear of the disease. This state of matters did not last long. On the 7th of October a fresh outbreak took place, and in eight days 32 severe cases of apparently natural small-pox occurred. I saw these sheep, with the exception of eight already dead and buried, but eight more fresh cases developed within the last fortnight. One sheep in a dying state was killed, and I performed a post-mortem examination. Other eight or 10 sheep were also in a very critical condition, and in my opinion could not live. I made careful inquiries as to the origin of the two outbreaks on this farm. The first was attributed to the sheep of a neighbouring farmer, who passed to their pastures within 200 yards from Mr. Zander's farm. The flock alluded to was seized about a month prior to the disease appearing at Hinter Bollhagen. The second outbreak appears very distinctly traceable to the introduction of a ram bought from Herr Busch, in Toitenwinkel, whose sheep had all been voluntarily inoculated without the previous manifestation of disease in a natural form. The ram seemed to have passed through the disease. I examined carefully Mr. Zander's flock, with a view to determine whether they had been efficiently inoculated, and I could find in all the traces of a previous local eruption. There had been no sloughing, and I particularly notice this, as it is justly stated, that when inoculation is followed by such a result, the preservative influence is not observed.

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My inquiries on a number of farms and from many persons indicate that at least on three-fourths of the farms in Mecklenburgh where the disease exists, it has been simply induced there by inoculation.

Inquiries as to extent to which inoculation is practical.

When on the continent I obtained useful information as to the outbreak of small-pox in Hanover, Holland, and Belgium. In Hanover I had the great advantage of meeting on several occasions with Professor Gerlach, Director of the Royal Veterinary College. Professor Gerlach, though a strong advocate for inoculation as a means of mitigating the losses by the sheep-pox when the disease has appeared in a flock, assures me that the continent of Europe suffers severely in consequence of the yearly inoculations in non-infected districts and non-infected flocks. Professor Gerlach had occasion to demonstrate this in the case of three duchies in Anhalt, viz.: Bernberg, Köten, and Dessau. Severe losses were annually sustained in these duchies until Professor Gerlach caused the yearly inoculations to be stopped. For several years past they have been quite free from the disease. It is owing to the practice which Gerlach properly condemns that Pomerania and Brunswick always suffer from sheep-pox, and from these countries it passes into Hanover. In 1861 the losses by the disease were very severe in Saxony, but more especially in Magdeburg and Halberstadt. This year (1862) it has continued to spread as usual from east to west, and has broken out in many parts of Hanover, such as in the districts of Nienburgh, Neustadt, Wunstorf, Liete, Mecklenhorst (very severe), Blumenhan, Pozzenhagen, and Wunstorf. When I left Hanover on the 27th of October, Professor Gerlach told me that the disease was spreading fast, and that he had been requested to address the farmers on the 5th of November as to the precautionary measures to be adopted to check the further spread of the disease. When in Hanover I visited several farms for the purposes of this inquiry. I ascertained that much disease had been due to the travelling of diseased sheep across the country from east to west, and towards Holland. Dealers had purchased diseased sheep, and no less than 200 animals were sold from one infected flock at Erstorf early in the summer. They were fat, and it was thought best to sell them before they took the disease. The losses were severe on this farm. The chief outbreaks in Hanover first occurred about the months of March and April.

Sheep-pox in Hanover and Saxony.

That small-pox has been very prevalent on the continent during the last two or three years is also proved by an outbreak in Belgium. It is rare to observe the disease in that country, more rare than I had been led to understand before visiting it. It is stated that no outbreak had occurred since 1823 and 1825 until 1860. Three hundred sheep from Germany, purchased in the latter year by a farmer at Petit Bœulx lez Nivelles, and mixed with 700 or 800 more sheep, soon manifested signs of the disease. Eight per cent. were lost before a competent veterinarian was consulted. Separation and inoculation were resorted to, and owing to great precautions taken the disease was limited to the one flock. I particularly notice this outbreak in Belgium, as it shows how German sheep travel far westward, crossing Hanover into Holland, as well as through Holstein from Mecklenburgh, for the English markets.

Sheep-pox in Belgium.

Holland has suffered severely for the last four years. Its sheep-rearing province is Drenthe, famed for its sandy plains, heather, buckwheat, and flocks of sheep. In no other Dutch province are the flocks so large or so numerous. Herr Moss, veterinary surgeon at Assen, has witnessed outbreaks annually since 1858. He has inoculated many flocks, and the losses have occasionally been very numerous.

Sheep-pox in Holland.

The districts most injured by it this year have been Rolde, Gieton, Borger, Buiven, Peize, where it has been for two years, Kolonie and Veenhuizen. In the two latter places it was raging severely when I was in Holland. Last year the disease appeared in Friesland, but there are no flocks of sheep there of any importance, and it has not committed great ravages in consequence. Some outbreaks have been witnessed in Gröningen, but none in North and South Holland or Zealand, so far as I could learn.

Exportation of diseased sheep from Holland.

That diseased sheep were, however, exported from Rotterdam early in the current year for England, I had ample opportunity of learning in the province of Utrecht. The farmers in this province have flocks varying in number from 100 to 200 sheep. The country is open, and I met many sheep crossing fields and travelling on the road. As in Wiltshire, the drovers prefer crossing country to the high roads, and every outbreak that I could trace was attributed to contact of flocks with the diseased sheep driven through the province. I observed the malady at Den Oond and in two farms at Schalwijk. When the malady was raging at Den Oond in the month of August, 26 sheep, apparently in health, were sold to passing dealers for the English trade. The 26 sheep were the only ones of a flock of about 120 that had not taken the disease at the time of their sale. They were, of course, infected sheep. Before I left Utrecht on the 28th of October I learned that the disease had spread to Gooij, and other farms near Holstein. It is particularly worthy of notice that the diseased sheep which traversed the province of Utrecht must have been shipped at Rotterdam about the months of April and May. Both in Hanover and Holland, as in Wiltshire, the first cases were observed at shearing time, but of course the diseased sheep that had communicated the disorder had passed through the various countries some time before the sheep were shorn. So far as I could learn the outbreak was a week or two earlier near Nienburgh in Hanover than at Den Oond in the province of Utrecht.

Small-pox in Wiltshire.

I am now led to consider the outbreak of small-pox in Wiltshire.

The history of that outbreak is a most instructive one, as it affords a striking illustration of the serious losses sustained by a disease of so contagious a nature from not having been recognized on its first appearance; it also affords us the most conclusive evidence with reference to the best means for the prevention of such a disease in future and the safest measures to adopt for the mitigation of losses when it happens unfortunately to appear among our flocks.

Mr. Joseph Parry's flock.

Mr. Joseph Parry, of Allington, owned at the commencement of this year (1862) one of the choicest flocks in Wiltshire. It was exclusively home-bred, and consisted of 992 ewes, 9 rams, and 710 lambs. Such a flock in the centre of the North Wiltshire downs might justly be regarded as not likely to suffer first from any contagious disorder. But the district turns out to be one not unfrequently visited by contagious disorders, and my attention has been specially directed to the peculiarities of that portion of country which render it liable to invasions of scab, and the foot and mouth disease, as well as the sheep-pox. The farm of Allington, about six miles north-east of Devizes, stretches over St. Anne's Hill or Tanhill, which is the centre of an extensive sheep district. It is also the locality in which there is an extensive sheep fair held annually on the 6th of August. Skirting this hill, and through the heart of the district about to be described, is the celebrated "Wan's or Devil's dyke," one of the divisions of the old Saxon heptarchy, and now levelled in some parts but prominent at others. The Wan's dyke takes a somewhat serpentine course from east to

North Wiltshire downs often visited by contagious diseases.

The Wan's dyke.

west. Standing on the Wan's dyke at Tanhill, and circumscribing a circle with a radius of six miles, an area is embraced of about 70,000 acres of land, resting on the chalk formation, with considerable tracts of the upper greensand, and the soils are proverbially healthy for sheep. Over this district there is, in many parts, one sheep to the acre, and the total amount of stock was computed in July to be about 50,000 sheep.

The system of management consists in folding the sheep on fallow land or green crop, according to the season, extent, and quality of the down, to which the sheep are driven every morning from April to November. Each farm has therefore a certain amount of arable ground in the vale and a strip of down on the hill. These strips of down are often connected with the arable land by a mere right of way or small strip of down, and the downs are limited for each farm by some faint undulation or mark, which we often failed to recognize, and which shepherd and farmer alone can define. Practically the downs are quite unenclosed, though legally we understand that the land apportioned to each farmer is looked upon as fenced, so as to protect him from intrusion, and is considered enclosed ground. Our readers may imagine in what sense this may be accepted, when we tell them that we have ridden and driven for miles on the downs, straight through all the infected farms, without deviating right or left, and without passing ditch, hedge, stone wall, or gate. Standing on an elevated spot the flocks are seen in every part moving side by side, one after the other, crossing each other's track, and affording ample opportunities for communion amongst the shepherds. The district is traversed in all directions by driftways, so that drovers can pasture their sheep on the downs for days, and go from Bristol to London with the payment of a single toll, or from Southampton to Ilsley, &c., in the same way. An extensive dealer has assured me that many hundred sheep driven for several days along the Wiltshire downs cost for travelling expenses 4*s.* a day. No money is needed for food, shelter, or tolls. There are some notorious dealers who have no farm or down on which to keep their flocks. They pick up odd animals at a low price, here and there, and drive over the downs, where they sleep, and move gently backwards and forwards on the pretext of travelling, but in reality getting food for their flocks. Many instances have occurred of the spread of contagious disorders, such as scab, the foot and mouth disease, foot rot, &c., from these infected flocks passing over the downs along the Wan's dyke.

Flocks close together.

Numerous driftways through the district.

The lowland portion of the Allington farm is skirted by the canal, and it is said that the sheep were near this canal when the disease first broke out. I find, however, that the first case occurred amongst a portion of the flock that had been daily to the down for about a week. My authority is the shepherd who drove them.

I visited the downs repeatedly, rode across them with gentlemen who knew the country well, spoke to drovers, shepherds, and other persons, and the more I inquired the more evidence did I obtain in confirmation of the facts gleaned by me the first morning I commenced my investigations.

My inquiries abroad indicate that of late years, but especially in 1861, and early in the current year, small-pox has been raging severely in the countries whence we derive stock. There have been no seizures of infected sheep, but many have undoubtedly been introduced in this country. Many were imported in the spring. With all these facts, I think the evidence is as complete as we need have it with regard to the contamination of the Allington flock. The very fact of that

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flock being away from public roads endangered it, and rendered the chances greater that drovers' sheep would feed by its side.

The Allington flock communicated disease to the sheep on Mr. Harding's farm at Etchilhampton. Then Mr. Stephen Neate, whose lands adjoin Mr. Parry's, discovered the malady, but only after having been to a fair at Marlborough with a lot of lambs. Fortunately Mr. Neate was so quick in getting back the lambs he had sold that they led to no further outbreaks. I ascertained the existence of the disease at Stanton, Horton, Hillwood, Avebury, and Langley farm. There was no mystery as to the communication of the disease in any case, with the exception of Mr. Church's flock at Hillwood, which, however, was folded by the roadside, where thousands of sheep are constantly passing. The extent of the loss sustained in Wiltshire is shown in the subjoined table.

TABULAR STATEMENT as to SMALL-POX in SHEEP in WILTSHIRE.

Name of Farmer.	Name of Farm.	Total Amount of Stock.	Losses before Inoculation.	Number of Sheep Inoculated.	Total Losses.	Date of Outbreak and Inoculations.
Joseph Parry	Allington	1,711	200	800	500	1st July 1862. Inoculated 2nd and 7th of August.
—— Harding	Etchilhampton	400	18	380	19	22nd of August. Inoculated 3rd week in August.
Stephen Neate	Allcannings	1,000	14 cases, but no deaths.	976	80	23rd of August. Inoculated 26th and 27th of August.
John Simpkins	Stanton	100	—	None.	2	End of August.
Thomas Giddings	Horton	450	—	None.	2	27th of August.
Thomas Church	Hillwood	360	—	None.	15	27th of August.
William Hulbert	Langley Farm	400	3	380	140	30th of August. Inoculated 15th and 16th September.
Isaac Dark	Avebury	400	—	None.	2	12th of September.
Simon Hitchcock	Allcannings	300	None.	300	19	Inoculated beginning of September.

Had all the flocks seized been inoculated, I am quite sure that the outbreak of small-pox would not have been brought to so quiet a termination. Had I inoculated Mr. Gidding's, Mr. Dark's, and Mr. Church's flocks, I have no doubt whatever that many more farms would have been infected by this time; and it is satisfactory to notice how very insignificant the losses were amongst the non-inoculated as contrasted with the inoculated flocks.

The losses on 3,811 sheep were 221 before inoculation had been practised, and the loss since has amounted to 537, or a total of 758 on 3,811, viz., very nearly 20 (19·89) per cent., whereas on 1,310 sheep not inoculated the loss amounted only to 21 sheep, or 1·6 per cent.

On all the farms where the separation system was carried out, the cases were very severe, but removed as a rule before they could contaminate other animals. The exception to this was Mr. Church's flock, in which one or two mild cases were observed late. The mortality on the cases at Hillwood was as high as 70 per cent., so that it could not be said that the disease was not virulent in character. Again, at Horton the cases were very severe: one animal recovered with difficulty, and the second died from a confluent variety of the disease. They were both confluent cases that I examined at Avebury, and one of the sheep at Stanton was very severely affected.

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d. Contagious typhoid Fever of Cattle.

The history of this—the Russian—plague reveals that in former times its outbreaks over Europe were due to wars and revolutions, and during the present century to cattle travelled from the east into central Europe by enterprising traders. It is a malady originating in the wide plains of Asia and European Russia, and it is asserted that even on many of the steppes the disorder is traced to imported cattle, and not to any causes rendering it enzootic there. At the present time the outbreaks of this disease are perhaps more widely distributed over Europe than at any previous period during the present century; but so exclusively is the disease due, in spreading, to contagion, and so energetic are the Governments of central Europe in protecting the herds of their people from the disorder, that it is not likely the malady will return to these islands unless in the event of a general European war. It traversed Europe and attacked our cattle a century since, but it is now too effectually kept in check in the Austrian and Prussian dominions to be transmitted from Russia to our own shores. The short period of incubation, and the decided features of the disease, with its marked fatality, prevent the insidious introductions which are so characteristic of the contagious pleuro-pneumonia.

2. *Enzootic Diseases.*

Though contagion plays such an active part in causing the spread of epizootic diseases over the United Kingdom, it cannot be said to exert any influence whatever in favouring the progress of maladies that originate spontaneously in the British Isles. The local influences operating in the production of enzootic disorders are numerous, but there are a few leading ones which deserve special attention being paid to them from the extraordinary losses they induce.

I shall refer more particularly to food, water, climate, geological formation and soils, systems of culture, and seasons.

a. Food.

When the enzootic diseases of Britain are compared with those of other countries, we do not fail to notice that there is a large preponderance in this country of that class of disorders dependent on the abundant supply of rich food.

Food for stock in great abundance in this country.

There is no doubt that the United Kingdom produces more food at present than there is live stock to eat it ; or, in other words, that a far larger number of animals could be annually reared and fattened on the food at present grown for them than there are. My travels indicate, unfortunately, waste in all directions, and that waste is due to two causes. In the first place, a limited amount of stock is kept on more food than is required for it; and animals fit for the butcher are frequently kept on to convert straw and green food into manure. Indeed, much artificial food is given with a view to improve the manure, and many plans have been resorted to in order to secure a large amount of fertilizing material in the best possible condition, and these plans have naturally referred to means of housing and feeding cattle which have been considered more for the sake of the manure heap than for the health of live stock. In many parts of Great Britain and Ireland farmers are finding out that grain crops are precarious, and that the feeding of live stock pays best. They find sheep safer than cattle, owing to the latter being destroyed to a great extent by the prevailing epizootics; and when stock has to be purchased, a far greater risk is run in buying a lot of cattle than a flock of sheep. This leads me to the second point in explanation of the waste of cattle food. When a farmer

Amount of stock kept too limited.

Excess of food depends partly on the reduction in the amount of stock by disease.

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has purchased a certain amount of stock, and pleuro-pneumonia appears, he experiences great difficulty in eating down his crops, the surviving animals get an excess, and perhaps a lot of turnips are ploughed into the soil as manure without having been touched.

We are not producing young stock enough to consume the food annually grown, and the comparatively scanty amount of stock we have is rapidly reduced by disease—by disease which I have already shown is in great part foreign to our land; but in proportion as the foreign diseases kill our stock, there is a surplus of food to favour the production of the most fatal of our enzootic disorders.

At a recent meeting of the Central Farmers' Club a very interesting paper was read on the advantages of rearing stock in preference to corn in this country, and various reports were read from different counties. The burden of speeches and reports were to the effect that far more stock could be reared and fed in the United Kingdom than has been done for the past. Farmers have purchased foreign cattle and sheep to graze, owing to the lack of British stock, but our foreign imports have not increased, and our home production has been extremely deficient.

The amount of food varies according to seasons, and we find that the worst period for many enzootic disorders is the spring, when the animals are changed from bare winter keep to luxuriant pastures.

The quality of food must be taken into consideration. There are many districts where enzootic disorders prevail, owing to the richness of the food. More facts are needed on this subject, but it is quite evident in practice that splenic apoplexy, parturition fevers, blood diseases in all animals prevail on farms and in districts where the soils are rich and the farmers liberal in the supply of manure to the land and even artificial food for stock. Since the introduction of turnip husbandry in this country, blood diseases, due to luxuriant crops of these roots, have made their appearance, and annually destroy cattle and sheep in great numbers.

The introduction of artificial food has had a beneficial influence on the health of stock especially in affording farmers an opportunity to keep up the condition of their young animals in winter, and thus avoid the sudden and dangerous transition from poor to rich keep above alluded to. The best of these artificial foods is the one which has occasionally led to severe outbreaks of diseases incidental to plethora—I mean oil-cake. Cases occur not unfrequently of animals fed on oil-cake dying off rapidly, and the cake is suspected to contain poison. Analysis, however, reveals that it is extremely rich, and the farmer has sustained the loss owing to a too liberal supply. Oil-cake given in moderation to young cattle is, perhaps, the best preventive we have for anthrax; but it will not answer the farmer's purpose to allow such rich food to animals *ad libitum.* I have often noticed the waste on farms from food of all kinds being thrown before stock without care being exercised in apportioning the proper quantity to each animal. Thus, I have known cake broken up for a lot of cattle and thrown into boxes in an open yard, and on weighing the cake have found as much as 14 or 15 pounds weight for each ox. I need scarcely say that the animals might greedily swallow the greater part of this food, but the waste would be enormous, and the health of the stock suffer.

Food induces enzootic disorders from peculiarities in its composition. There is no doubt that the plants growing in fields adjoining or in the midst of woods are not too rich or too poor in nutritive elements when they induce enzootic dysentery. They contain deleterious principles. Animals thrive best on food charged with considerable moisture; and it is to the solid and dry condition of the plants on many hill pastures that we must attribute blood diseases. There is a wide field for investigators in this branch of study.

Enzootic disorders abound in districts where roots and grains are grown on ill-drained lands. Anæmia, asthenic hæmaturia, rot, are all due to this cause. Turnips grown in the same soil induce no disease if reared on fields that are drained, whereas on adjoining fields, where the land is wet, they acquire properties which render them unwholesome food for cows and other animals.

b. Water.

If food is a very prolific cause of enzootic diseases, either from its abundance or scarcity, its richness or poverty, the excess of certain elements or lack of others, it is not less the case with water.

It has been supposed that the filthy water which animals are constantly allowed to drink is a prolific source of disease, but there is not much evidence to prove that animals do suffer unless the water becomes charged with a poison, such as lead, or contains an excess of lime, as in some districts where urinary calculi are very destructive amongst sheep, as on the Cotswold hills.

Professor Voelcker's observations on impure waters inducing disease in animals.

Very interesting observations on the constitution of water in inducing disease were recently made by Professor Voelcker, who was deputed to analyze the water in a district were splenic apoplexy was raging. Professor Voelcker reported that "he had analyzed four different kinds of water, and one contained no less than 235 grains of solid matter to the imperial gallon. This solid matter was composed of various medicinal salts, which must necessarily affect the whole constitution of animals; and he did not feel in the least surprised that animals supplied with such water had become subject to serious disease. It was clear-looking water, but was, nevertheless, very foul indeed. Among other things, it contained nitric acid, as much as one grain to the imperial gallon; and 19 grains of organic matter showing that somehow or other, refuse materials accumulated on the surface of the soil underwent regular nitrification, and found their way, in a more or less completely organised state, into the whole of pump water. Then, again, there was a large proportion of sulphate of soda, sulphate of lime, sulphate of magnesia, and some sulphate of potash. These were salts, which in their combinations had a medicinal effect very much greater than that which they produced separately. It was a well-known fact that in certain districts of Somersetshire, where tart or scouring lands prevailed, medicinal effects frequently occurred. On referring to the composition of some water in a district near Bridgewater, he found that it contained less solid matter, namely, 202 grains to the imperial gallon. The water on Mr. Bradley's farm being examined, contained 235 grains; it was, unquestionably, mineral water, a single tumbler full of it taken in the morning being sufficient to produce a decided medicinal effect. There could be no question then, that in a lias district there were materials having a tendency to produce disease, whether it were splenic apoplexy, scouring, or some other disease, he could not say, but that such water could not be drunk with impunity was certain. There was other water which was evidently impregnated with the drainage of the farm-yard. It must be undesirable that animals should drink such water, as impurities were injurious; but nevertheless he must remark that all ditch water, and water apparently foul, proved, on analysis, to be the purest description of water. On analysis it was found to contain only 26 grains of solid matter to the imperial gallon, and in the solid matter there were only four and a half grains of organic constituents."

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c. Climate.

There is a great difference in the diseases of different climates, and the same disease is modified by temperature, winds, moisture of the atmosphere, &c. I need not enter into many particulars on this subject, and have only to refer to the remarkable prevalence of rheumatic disorders of animals, and especially of calves and lambs on high and confined districts ; to the fortunate rarity with which in one cold country the anthrax poison is developed as contrasted with the development of that poison in hotter parts of Europe, and to the very significant fact that no climate in Europe is more favourable for stocks than our own, and in no country can animals be so readily kept from one year's end to another on the fields that may justly be said to be evergreen. In Italy stock must be removed from the hot plains where the grasses are scorched and withered; and in Germany sheep and cattle must be huddled together in stables in winter, and fed on hay and other available food. Here stock thrives at freedom better than in, perhaps, any other country in the world. To our climate we owe, in a great measure, the extraordinary superiority in the breeds of our animals as contrasted with those of other countries ; and lastly, to our climate we owe the exemption from plagues, which are only seen amongst us as introduced by diseased foreign stock.

d. Geological Formations and Soils.

In the present state of knowledge it is difficult to state with certainty that a disease is due to special geological characters in a district where it prevails. The malady that merits special reference under this head is anthrax. There is no doubt that the development of anthrax in different parts of a country like our own depends, to no small extent, on the geological peculiarities of districts. Heusinger has said that it occurs on the granitic and chalk Alps, on the granite of Lapland and Finland, on the transition chalk of St. Petersburg, and on all the tertiary strata.

The distribution of anthrax in relation to soils in the United Kingdom.

In Great Britain and Ireland anthrax is the most fatal of all enzootic disorders, spreading widely over the richest pastures of fertile valleys on the old or new red sandstone formations ; on the soil over the lias of Somerset and Gloucester, on the crag forms of Norfolk and Suffolk, on the compact soil of the Oxford clay in Oxfordshire, Wilts, and the county of Lincoln. In the counties of Edinburgh and Haddington we find it particularly prevalent, stretching from Dalkeith to the Lammermuir hills ; indeed, in the south of Scotland along the whole tract of Cambrian and Silurian rocks. The hills of Scotland and the pastures of great fertility intervening between them teem with cattle and sheep, amongst which there is a heavy mortality from the different forms of anthrax. The black quarter of cattle, which is one of the most characteristic forms of this disease, prevails to a great extent on the old red sandstone of the counties of Ayr, Stirling, Perth, Forfar, and Kincardineshire. It is seen often in the same formation in the eastern portions of Banff, Inverness, and Caithness. It is common also in Kincardine and Aberdeen, prevailing, perhaps, as much on the lower Silurian of the latter county, as on the same formation in Peeblesshire and Berwickshire, and on the igneous rocks of Renfrew and Kinross. Though I have here mentioned most of the formations on which the various forms of anthrax prevail, I must not omit to mention its ready development on the clays of Mid-Lothian, Linlithgow, Lanark, and Renfrew. The soils on the coal measures, where not well drained, are also favourable to the development of anthrax in cattle; and although it may seem puzzling to state where carbuncular diseases do not occur, still it will

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be found not to occur to any extent on the thin soil of the upper chalk, on the sand soils over the greensand, on the millstone grit, and magnesian limestone. Where the latter formations occur in Durham, Yorkshire, Derbyshire, Staffordshire, and Devon, the diseases, so far as I can ascertain, rarely occur.

In Ireland anthrax prevails in all parts.

In connexion with the prevalence of anthrax diseases in the United Kingdom there are two remarkable facts; 1stly, that they are very widely distributed over the land owing probably to the abundance of clay in its soils; 2ndly, this clayey nature of our soils renders them most profitable as pasture lands, owing to the expense attending their cultivation for other purposes; they require deep drainage, however, to ward off such diseases as anthrax and others that depend, not a little, on moisture for their production.

Bone diseases on high mountains.

Soils on our highest mountains are deficient in phosphates and other salts of lime, and this is the cause of a singular malady amongst cattle, "cachexia ossifraga," or "fragilitas ossium." This disease, known by the names of "cripple," "stiffness," and "cramps," &c., prevails under similar circumstances in the mountains of central Europe, and in those of Scotland and England, Wales and Ireland. The loss annually sustained amongst cows thus kept on soil ill suited for them is very great, and more upon cows than other animals, owing to the amount of phosphates required for the young they bear.

e. Systems of Culture.

Artificial and other manures.

Soils are modified by the farmer in preparing them for the reception of special seeds. Manures are distributed, and according to the nature of these manures do we have the development of enzootic disorders. It is no doubt in a great measure due to the liberal use of artificial manures that plethoric diseases are becoming annually more destructive amongst stock. There are instances in which special diseases are induced by the application of certain manures on land. Thus, nitrate of soda has been known to induce severe forms of diarrhœa. In many parts of Scotland the distribution of police manure* leads to the occurrence in many districts of fatal forms of lead poisoning, owing to the refuse lead from painters' shops, &c. such manure contains. Much might be said on the influence of different systems of cultivation in the production of disease, but under the head "Food," "Soils," &c., I have noticed some leading facts as to circumstances inducing disease which depend on the condition of land, and hence on the food grown in it, so that I shall pass from this to say a few words on

f. Seasons.

Enzootic disorders are most prevalent in spring and autumn. They often attain great fatality in summer, and only a few are most rife in the winter season. It is not, however, the temperature of seasons that alone influence the development of diseases, but in different districts animals are subjected to various influences in different seasons. And we find that amongst sheep fed for the butcher, blood diseases are common when these animals are placed on turnips in November. Amongst ewes similar diseases prevail more towards the spring. Braxy is a disease of winter and not of autumn. The most important fact that I wish to draw attention to under the head "Seasons" in this report is, that during very hot summers we have reasons to fear the development of blood poisons likely to communicate disease from brutes to human beings.

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* The manure collected in large towns.

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3. *Parasitic Diseases.*

Parasites travel from place to place and animal to animal in many ways. They are *invariably* generated from pre-existing parents, and no parasitic malady can be attributed to other causes than those which favour the multiplication of animals in accordance with the laws of reproduction. "Rot," in sheep associated with the development of a sucking worm, occurs where distoma hæpaticum meets with favourable opportunities for its migrations. Scab in sheep is found amongst animals that come in contact with diseased ones in markets or on drift-ways. "Measles" in the pig I have shown to occur in the United Kingdom where swine are most likely to eat human excrement and joints of tænia solium. "Sturdy," in sheep due to cœnurus cerebralis, destroys hundreds of animals where circumstances favour the dissemination and preservation of tapeworm eggs from the dog. The myriads of thread worms which choke our sheep and calves, or make pheasants, fowls, and turkeys, gape, owe their origin to the dissemination of ova. Lambs are fed on a second crop of clover, the first crop of which has been fed off by older sheep, and the result is that they carry into their systems germs left for them by their parents. Human beings suffer from trichinæ which pigs breed for them, and cases of death in man are not uncommon from hydatids, which are constantly multiplying in the bodies of the lower animals. To ascertain, therefore, the cause of any parasitic disease, we must investigate the laws which govern reproduction in the animal kingdom. The causes which predispose animals to parasitic diseases are all those which tend to weaken, such as filth, foul air, bad food, impure water, and overcrowding or overstocking.

IV.—THE TRADE OF THE UNITED KINGDOM IN CATTLE, MEAT, AND MILK.

1. *The Cattle Trade.*

Changes in the cattle trade.

During the last 20 years the home and foreign trade in cattle have completely changed aspect. First, there has arisen an import trade, which was not in existence before the 9th July 1842. Next, in consequence of the great mortality which that import trade has occasioned, farmers and dairymen have sought to lessen their liability to loss by purchasing cattle in high condition; cattle which, if the owner should wish it, may at once be sold to the butcher. And further, the consumption of beef having increased with our increasing population, extensive meat manufacturers, if I may so call them, have sprung up, who buy from breeders and dealers (in order to fatten) stock that was formerly in great part fattened where it was bred.

a. The home trade in cattle has three stages,—the sale by the breeder, the purchase and sale by the grazier, and lastly, the purchase and sale by the stall-feeder. In the second and third of these stages there is the transference of cattle by rail, road, or steamboat to parts distant from the breeding districts, establishing a communication between the three kingdoms. In order to explain this part of my subject as clearly as I can, I must consider the trade in calves, in cows, in lean store and in fat cattle.

Trade in calves.

Calves are annually growing scarcer. The grazing and feeding systems pay so well that there is keen competition for calves. Moreover, annually is the production of food for cattle increasing, land is reclaimed, and stock is needed, but there is not a proportionate increase in breeding. There is certainly a decrease. The breeder must keep a certain amount of his yearly produce to recruit his stock, and the pur-

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chaser of calves is driven to buy from dealers and in markets. The animals thus obtained are to a very great extent the calves born in the dairies of our large cities, and in those counties where the production of butter and cheese pays far better than rearing the calves. There are men constantly engaged in buying up calves from all sources, and the circumstances under which the animals are born, coupled with the very cruel treatment they often receive afterwards, lead to a very heavy mortality, especially in the hands of the buyer. In the event of their looking ill, their throats are cut, and they are sold as human food.

Thousands of calves born in the dairies of London, Manchester, Birmingham, Liverpool, Glasgow, Dublin, Edinburgh, and other large towns, where pleuro-pneumonia is annually destroying upwards of 50 per cent. of the cows, are bought up as above.* The persons who purchase them may escape pleuro-pneumonia and other contagious diseases which they have been in the way to contract, but in the majority of instances he has to sustain a heavy loss by dysentery,† or (in the case of Cheshire and some other calves) by the ravages of the strongylus, which infests the lungs and air passages. It is very important that I should here notice the fact that the annual introduction of fresh virus for the outbreak and spread of contagious diseases in Ireland occurs chiefly by diseased calves. Older animals are imported in small numbers, and are generally in a much healthier state.

Trade in cows.

As regards the trade in cows, it is customary in the large dairy and breeding districts to pick out all stock that must give place to younger animals, and to sell it for town purposes. In many districts this business is partly conducted by graziers, who buy up these cows in their neighbourhood, keep them awhile on their own farms, and then sell them to dealers, or take them to country markets. So far this stock is healthy, but it consists in a great measure of old cows which do not carry very much flesh, and are therefore not so acceptable to the town dairyman as the large short-horn crosses which are obtained in perfection in the north of England. Before the importation of cattle and disease, dairymen bought aged and cheap cows, which were often large milkers, and could be got up into fair condition. But when pleuro-pneumonia appeared, these animals died as fast as the fatter ones now do, and when thus seized would only realize from the butcher little over skin's value. In some cities, such as Dublin, lean cattle are still bought by a class of poor dairy-keepers who have not capital to engage in large speculations. Indeed, fat diseased cows could not be so easily disposed of at high prices in Dublin as in England or Scotland, where they are sent in all directions to dead meat markets. Thus in Dublin the price realized for a diseased cow varies from *2l.* to *5l.*, and as much as *6l.* may be given for a very fat one. In London and Edinburgh I have seen many diseased cows sold at all prices from *10l.* to *20l.* It is true that some of the leaner ones allowed to stand a few days may still only fetch hide's price, but the dairy-keeper of the present day buys a pair of large, young, fat short-horn cows at prices varying from *40l.* to *60l.*, knowing that he may get their milk only for six weeks or two months, and then sell the pair at a very moderate discount.

Why are the cows in our large towns constantly destroyed by contagious diseases? A dairyman is always buying. The cows he buys

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* It is true that they have not lived long in the dairies where they were born; sometimes not an hour, but at other times some days.

† This is a disease very comparable to the infantine diarrhœa of the human subject. It has its origin partly in unwholesome conditions of housing, and partly, perhaps principally, in the system of artificial feeding under which they are kept.

start from the breeder's hands healthy. They are being transferred from place to place in contaminated trucks, or, perhaps, in the same truck with diseased cattle; they pass through one or more markets, are there constantly placed in contact with diseased cattle, and, lastly, enter cow-houses,—sometimes very ill-conditioned cow-houses,—where disease exists, and whence in every probability they must themselves issue diseased.

In the case of our town-cows the system at present carried out condemns, I believe, at least half the animals to be slaughtered diseased. Are all these cows sold as human food? With few exceptions they are; and, if they were not, town dairymen would be ruined. The principal exceptions are those of the leaner animals, which (as I shall afterwards show) are bought up for use in piggeries, and only indirectly contribute to the supply of human food. It is important here to notice that a fat diseased cow (sold at 18*l.* or 20*l.*) is not usually eaten as inferior meat.

Breeders have now found that they cannot, as they once did, recruit their stock from a distance and through markets. They accordingly buy to a great extent from each other, and thus in a large number of breeding districts stock is free from contagious disorders. The contrast between the health of cows in the breeder's hands, and that of cows in the dealer's and dairyman's hands, is worthy of particular attention.

Lean store cattle.

The trade in lean store cattle is indispensable to supply our graziers and feeders. A very large number of yearlings, two and even three year olds, are sold out of the districts where they are born and reared to that age. The period at which they are sold varies according to the locality and the breed. These young cattle, subjected often to considerable privations, are driven to country fairs. On the road and in the market they first meet with diseased cattle; and in proportion to the distance they have to travel and the number of markets they have to stand are the chances of contamination increased. It is owing to this, and to this alone, that Irish cattle enjoy the unenviable reputation of spreading much disease throughout England. These animals are first sold in the northern and western counties of Ireland; they are driven from fair to fair, and often change hands, until they reach the port where they are shipped for Glasgow, Liverpool, or Bristol. By the time they have travelled far into England or Scotland, the period of incubation of pleuro-pneumonia has expired, and then many of them die. I cannot speak too strongly of the exposure of diseased cattle amongst animals destined for store purposes. In the Edinburgh market I have myself bought for dissection diseased yearlings which farmers had purchased in the same market a week or two previously, and had afterwards found to be infected. Though lean cattle are much mismanaged, individual farmers do not lose so much on them as on the fat ones. When a few show signs of disease the whole are despatched to market, and thus the loss is distributed over many. It is true that so long as the diseased lean cattle are kept on, the loss must be equivalent to their full value, as they are not fit for the butcher.

Fat cattle.

I have, lastly, to consider the trade in fat cattle. The lean animals that have escaped disease, or pass through it, attain the condition of being half fat. They then travel and enter the markets again, and if they have previously escaped contagious disorders, the chances are that they do not again escape. The stall-feeders, being aware of this, like to buy animals in fair condition. The larger butchers buy considerable lots, and put them on good grass, oil-cake, turnips, or other food they may have, and thus rapidly fatten them. Pleuro-pneumonia often

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breaks out; indeed, in such counties as Meath, Fife, and Norfolk, it is below the mark to calculate at 12 per cent. the average loss on cattle in this stage of the trade; and the loss would be still greater did the feeder not adopt the dairyman's practice of sending all diseased cattle to the best market in the neighbourhood, or to the butcher, who always buys them. I have on various occasions known lots of 30 or 40 cattle thus slaughtered, one by one, until the whole had been delivered with diseased lungs to the butcher. Infected fat cattle are seen in all our weekly markets; they are eagerly bought up, and they contaminate store stock to an extraordinary extent.

It is evident from the foregoing statements that in every way the home trade in cattle is engendering disease.

Importations prior to 1842 in co. Cork.

b. *The foreign cattle trade* is of recent date. Prior to the 9th July 1842 the importation of live stock into this country was prohibited, but some animals for breeding were from time to time introduced. Some of these importations took place in Ireland through the port of Cork; Dutch animals thus imported towards the end of 1839, in 1840 and 1841, were chiefly cows for breeding purposes, and the farmers of county Cork well know that they introduced contagious diseases into the country. No such importations have occurred there for many years past, but the numerous crosses seen around the city of Cork indicate that Dutch blood is flowing in their veins. From July 1842 until 1846 animals were imported on paying a duty of 20*s.* a head on oxen and bulls, 15*s.* on cows, 3*s.* on sheep, 5*s.* on hogs, &c. The anticipated reduction in the prices of butcher's meat were not realized, and Sir Robert Peel initiated the plan of admitting foreign lean stock into our ports duty free. Our importations have in consequence largely increased,* but the effect of these importations on the national supply of animal food has been, on the whole, unfavourable.

Duty paid on live stock from 1842 to 1846.

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*An ACCOUNT of the NUMBER of CATTLE, SHEEP, AND SWINE imported in each Year since 1842, inclusive.

Years.	Cattle, Sheep, and Swine imported into the United Kingdom.					
	Oxen and Bulls.	Cows.	Calves.	Sheep.	Lambs.	Swine.
1842 (after the repeal of the prohibition on 9th July).	3,156	1,038	70	634	10	410
1843 - - -	1,114	368	39	210	7	361
1844 - - -	3,682	1,154	53	2,801	16	265
1845 - - -	9.743	6,503	587	15,845	112	1,590
1846 - - -	17,191	25,349	2,503	91,732	2,892	3,856
1847 - - -	27,831	35,480	12,406	139,371	3,349	1,248
1848 - - -	24,590	22,506	15,642	128,406	2,177	2,119
1849 - - -	21,884	17,920	13,645	126,248	3,018	2,653
1850 - - -	28,951	17,757	19,754	137,646	5,852	7,287
1851 - - -	37,624	24,026	24,870	192,585	9,274	15,599
1852 - - -	40,533	25,038	27,490	217,694	12,343	10,524
1853 - - -	56,220	38,328	30,705	249,446	9,974	12,757
1854 - - -	62,937	25,271	26,130	176,338	7,098	11,077
1855 - - -	63,687	10,063	23,777	156,646	5,996	12,171
1856 - - -	52,019	9,843	21,444	135,588	9,471	9,916
1857 - - -	53,277	12,371	27,315	162,324	14,883	10,678
1858 - - -	47,912	14,106	26,983	172,079	12,403	11,565
1859 - - -	55,960	7,334	22,383	236,628	13,952	11,084
1860 - - -	70,023	6,987	27,559	305,422	14,797	24,452
1861 - - -	71,288	9,906	25,902	293,919	19,004	30,308
1862 - - -	64,461	4,357	29,069	276,079	23,393	18,162

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Countries from which we import.

Holland the seat of much disease.

Our importations are from Denmark, Holland, Belgium, Germany, France, and Spain. The healthiest are from Spain. Many of the cattle fattened in Schleswig-Holstein are also sound. But through the ports of Hamburgh, Harlingen, Rotterdam, and a few more, we are brought in communication with distant and diseased lands. So far as Holland is concerned, diseases prevail chiefly in the provinces adjacent to the ports whence we receive stock, particularly in the provinces which communicate with Harlingen. Pleuro-pneumonia and epizootic aphtha entered Friesland when Harlingen became the centre of speculating cattle traders to supply the English markets.

Supply of cattle from thinly peopled countries.

Cattle trade last century.

It is quite natural that where populations are thin and grass lands abundant, cattle can be reared at small cost and exported to the countries where animal food is in great requisition. For this reason there has been from time immemorial a traffic westward from the Russian plains and even Asiatic steppes towards Hungary, Poland, Prussia, Austria, Italy, and France. Similarly, cattle-rearing countries in the north-west of Europe not only supplied themselves, but sent cattle southwards. This has been the case with Holland, and it has been the case with the northern provinces of France. Before the present century this European cattle trade was not very extensive; and during last century it was disturbed by perpetual wars, which led to the transfer of cattle in all directions, and to the consequent outbreak of plagues, especially the steppe disease and pleuro-pneumonia. Until 1815 the normal traffic of times of peace could not be established; but from that year onwards a new order of things has been in progress. In Austria, Prussia, the German States, Holland, and Belgium agriculture advanced; manufactories were established; sugar, starch, and spirits were prepared from vegetable products, and the enterprising capitalists soon discovered that it would be profitable to apply for the purposes of fattening cattle the different kinds of vegetable refuse left by such manufacturing processes. Lean stock was accordingly bought up in all directions, and rapidly fattened for consumption in large towns. Railroads and steam navigation soon gave assistance to this trade; and lean Russian or Hungarian cattle, which had been fattened in Austria and Prussia, found their way into France, and later into England.

Cattle feeding by distillers since 1800.

Influence of steam power on cattle trade abroad.

Then our new tariff of the 9th July 1842 came into operation. The already growing movement of foreign cattle was again considerably increased; and, for the first time, a current was established through Holland to our island. Formerly Holland had bred cattle for central Europe; it now, for our market, drained central Europe.*

There has been a general impression that our commerce is only with Holland. This is incorrect. Through the ports of Holland, and through Hamburgh, our markets are supplied not only with Dutch cattle, but also with the produce of the more thinly populated parts of Hungary, Wallachia, Moldavia, Prussia, Voigtland, Mecklenburgh, the Rhine Provinces, Hanover, Jutland, Schleswig-Holstein, and all other accessible regions, not forgetting even the Tyrol. Among the enumerated countries there are some † into which steppe disease is often imported; some where sheep small-pox is constantly kept alive by inoculation; some from which pleuro-pneumonia and epizootic aphtha are never absent. It was at one time thought that foreign cattle would be chiefly useful here for store purposes. Had they been healthy this

Foreign cattle not suited for store purposes in consequence of disease.

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* It deserves notice that during its former trade Holland had remained healthy; but now, when it began to import, it also began to lose by disease.

† Hungary, Wallachia, Moldavia, and Prussia.

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would have been the case, but however good their quality, they come from infected districts and die off rapidly.*

Universal practice abroad of selling diseased or infected cattle.

Dealers' profits large in infected cattle.

Wherever I inquired abroad as to the stock sold for the English trade, I learned that it is a universal practice to sell out the remnants of diseased herds and flocks. One great cause operating in favour of the shipment of infected herds for Britain is the low price at which the dealer can buy them. Very large profits are occasionally made by dealers, who, hearing that disease has broken out in a farm, offer a lump sum for the whole infected stock, and send it to Hamburgh, Harlingen, or Rotterdam for the British trade. Animals are bought at a diseased price and sold at a healthy one. This practice is not confined to cattle, as sheep from infected flocks are exported in large numbers from Mecklenburgh, Holland, Hanover, &c. My observations as to small-pox in sheep prove this, and show that not only live animals, but the skins of diseased ones, are freely used and transmitted without precautions from country to country, and from the continent to Great Britain.

Diseased stock introduced into this country.

Speculators have certainly succeeded in introducing large quantities of infected stock into this country. It is entirely owing to the Dutch trade that in 1862 we suffered more by the foot and mouth disease than at almost any previous time. Three distinct and very severe outbreaks have been noticed in Scotland; and the whole of England and Ireland, with the exceptions of a few breeding districts, have been visited by the troublesome plague. Foreign stock also communicated the disease to our show animals in Battersea Park.

c. *Live Stock Markets and Fairs.*

Country fairs and town markets.

Throughout the country there are monthly, quarterly, or yearly fairs for the purchase and sale of stock in addition to the markets in towns, where animals are traded in with varying frequency.

No precautions taken to preserve the health of stock exposed for sale.

Local county fairs most healthy.

All the live stock markets are conducted in this country without adequate precautions against the presence of contagiously diseased animals. The danger is greater or less according as the stock has been more or less circulating in the trade. Thus the Devon cattle, bred and reared in their own county, may be bought up at South Molton, Crediton, or Exeter, without danger of buying animals affected with contagious disease. The same may be said of Channel Island cows sold at Southampton, of the Herefords at Hereford itself, of Sussex cattle at Lewis, of Ayrshires at Cumnoch or Castle Douglas, of West Highlanders at Campbeltown, of black cattle at Muir of Ord or Amulree. In Ireland the stock is, as a rule, healthy at any of the local fairs in the Western counties; and the Kerry cattle purchased at Ballinclare, Dumbeen, Castle Gregory, or Tralee are likely to be healthy; whereas they are very probably contaminated by disease by the time they have passed through Ballinasloe and Dublin. For

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* Mr. Robert Herbert has repeatedly noticed this in his interesting papers in the Royal Agricultural Society's Journal on the statistics of live stock and dead meat for consumption in the metropolis. Last year he said:—"In 1860, owing to the falling " off in the condition of the beasts disposed of, and the unusually high rates demanded " by the breeders, it was apprehended that our deficiency was such that it would be " found necessary to import large numbers of stock from the continent, whatever " might be their condition, to meet our future consumption. The apprehended " deficiency, however, has not had the effect of increasing our importations to any " extent, and we believe that very few graziers are to be met with who, from past " experience, would run the risk of endeavouring to fatten foreign stock upon any " description of land. A few ventures have been made by large agriculturists, but " they have nearly all resulted in a heavy loss. . . . . . . Some of our best foreign " beasts, those imported from Holland, are peculiarly liable to disease."

Defects of live stock markets.

Fairs held in infected districts.

obvious reasons, the principal defects in the system of our live stock markets are to be found in the greater centres of trade in or near large towns. But it deserves mention that however fiercely disease may be raging in a district, fairs are not put off or transferred to other places; and that thus the country markets sometimes contribute greatly to the spread of contagion. In Austria and Prussia great attention is paid to this with the best effect.

Indiscriminate admixture of cattle for slaughter with cattle for store purposes.

In our large towns cattle for store purposes and cattle for slaughter are mixed indiscriminately. The diseased cattle, which the farmer or the cow-feeder sells, are exposed on the public market side by side with the stock purchased by cow-feeders, graziers, stall-feeders, and others. I have repeatedly seen them huddled together in the markets of Edinburgh and Glasgow, of Dublin and Liverpool, Birmingham and London.

Admixture of foreign and British cattle.

Moreover, foreign stock is exposed in our markets and mixed with British. And this is the constant source for the renewal in the supply of virus for the propagation of all contagious diseases.

d. Dead Meat Markets.

In the largest towns there are important emporiums for the sale of carcases and retail trade in meat. The meat supplied to these markets is slaughtered to a great extent in the large towns, but much is sent up from the country ready for sale. From all sources the dead meat markets are contaminated by the carcases of diseased animals. And so far as these are derived from the county, the receivers may have no means of knowing that the animal was diseased. Many of the worst forms of disease are very sudden, and only slightly affect the colour and texture of the muscular apparatus. A fine, fat bullock, with florid meat, may have died from splenic apoplexy, or been merely killed, *pro formâ*, when already on the point of death. Remove the spleen, and the carcase appears sound! Yet dogs and pigs in this country die from eating, *although first cooked*, any portion of such cattle.

We, therefore, never hope to purify our dead meat markets unless by a system which covers the entire country. The best butchers in London, Edinburgh, and elsewhere must occasionally send to the dead meat markets for prime cuts, which they cannot get in sufficient quantity from their own killing, and in ignorance of the fact may, and do serve, diseased meat to the wealthiest in the land. Dead meat markets supply diseased meat for all, and not for the poor alone, as some people suspect.

My personal experience of dead meat markets is most unsatisfactory. In Edinburgh between 100 and 200 diseased cattle are sold every week in the dead meat market. Carcases of diseased animals are smuggled into it by night, conveyed sometimes from piggeries adjoining the town, covered with the healthy carcases of sheep. And openly or by subterfuge there is an enormous traffic of this kind.

SLAUGHTER-HOUSES.

From all I have said already, it is evident that diseased cattle are slaughtered without restriction in slaughter-houses of all kinds. There are in some towns private slaughter-houses distributed as generally as the butchers' shops, and indeed contiguous to them, while in a few towns there are public slaughter-houses. The private slaughter-houses are the most objectionable; but wherever I have seen public slaughter-houses, they have been much mismanaged, and have entirely failed to give the protection which such establishments are expected to give against the slaughtering of diseased animals for human food.*

Private slaughter-houses, which I have visited in large numbers in different parts of the United Kingdom, I have found, as a rule, in objectionable situations;—in alleys and closes where there is not sufficient room to keep live animals waiting to be killed, nor adequate accommodation to dispose of the offal; and much organic matter remains putrefying in the fissures of bad pavements, and in inefficient drains. Numerous slaughter-houses in London and Dublin afford examples of very improper establishments for the purposes to which they are applied. The putrid emanations from these slaughter-houses are such that meat cannot be long kept in them, or in shops adjoining them.

Polishing carcases.

It is, moreover, impossible to superintend the private killing-houses, scattered as they are in great numbers over a wide area. In Ireland I saw diseased cattle slaughtered in large numbers in private slaughter-houses, and in a court adjoining one of these establishments I found 10 animals (cows and lean bullocks), of which nine were badly affected with pleuro-pneumonia. In London I have seen butchers in such places dress extremely diseased carcases, and "polish" the meat. This filthy practice consists in killing a good fat ox at the same time that a number of lean and diseased animals are being killed. Boiling water is at hand, and when the lean animals have been skinned, their flesh is rubbed over with fat from the healthy ox, and hot cloths are used to keep the fat warm, and to distribute it over the carcase, that it may acquire an artificial gloss, and an appearance of not being totally deprived of fat. In Edinburgh I have seen sickly lambs without a particle of fat about them dressed up with the fat of healthy sheep much in the same way. From the private slaughter-houses in London I have known even the diseased organs themselves sent to the sausage-maker. In company with another member of my profession, I have seen a carcase dressed, and portions of it prepared for sale as sausage meat and otherwise, although thoracic disease had gone on to such an extent that gallons of fetid fluid were removed from the pleural sacs, and that large abscesses existed in the lungs.

Private slaughter-houses in the country sometimes contribute to spread disease. I have known pleuro-pneumonia break out repeatedly in a field adjoining the slaughter-house of a country butcher.

d. The Pig Trade, including Ham, Bacon, and Sausage Factories.

I have already referred to the very frequent attacks of cysticercus cellulosæ, echinococcus veterinorum, and trichina spiralis from which swine suffer. And not only do pigs living indiscriminately among human beings in Ireland receive into their system the germs of hydatids, to be prepared for development into cestoid worms in man again, and serve as a home for other parasites, but also in other ways pigs are much damaged in health, and their flesh is thereby much deteriorated.

It is a common practice to feed pigs on the flesh of horses and of other diseased animals, or on the entrails of cattle and sheep that cannot be utilized so profitably in any other way. This animal food is supplied, as a rule, without being cooked, and only mixed with the vegetable matter and fæces contained in the alimentary canal of the herbivorous quadrupeds. In one place near Edinburgh, and another in Fife, the flesh is boiled for the pigs, simply because it is found profitable to

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* I would particularly instance the public slaughter-houses of Edinburgh and Aberdeen.

skim the grease and sell it separately. In these establishments the dust of mills or "mill sweepings" is the only vegetable material added to the animal diet.

Offal from the Edinburgh slaughter-houses used for feeding pigs.

I have referred to the gross mismanagement of slaughter-houses. Not an insignificant part of that mismanagement in Edinburgh is permitting entrails, diseased organs, and sometimes condemned carcases to be carted away by farmers, who throw the whole raw to their pigs. It is evident that no more certain means could be devised to spread parasitic diseases in such animals, and to render them unfit for human food; and I think it will be admitted that animals should not be fed so that they may merely increase rapidly in bulk, to be slaughtered as human food, when such systems of feeding render them diseased.

Health of carnivorous pigs.

I have made careful inquiries as to the health of carnivorous pigs, and find as follows;—that sows fed on flesh give birth to pigs which cannot be reared, but die shortly after being born; that if very young pigs are admitted to the flesh diet, they also soon die; that pigs of two or three months old seem to thrive on flesh, though the mortality amongst them is sometimes considerable; that pigs fed on flesh have a peculiarly soft diffluent fat, emit a strong odour from their bodies, and after death putrefy more rapidly than others. I also find that when any pigs die on the establishments above noticed, they are devoured by their companions, and frequently boiled for that purpose.

Ham and bacon factories.

While, on the one hand, men are to be found feeding pigs on the revolting system just noticed, I believe it to be an universal rule that diseased pigs are pickled and sold as bacon, ham, &c.*

In Belfast there are many extensive provision dealers who buy hundreds of pigs per day. These animals are generally slaughtered in the country and sent into Belfast, where they have only to be split up, chopped into pieces, and pickled. They are purchased by weight. Two men stand by the cart on which a huge load is heaped. One man makes a deep incision behind either elbow, and the other cuts between the thighs. These cuts are made to determine if the pig is measly. On every measly pig thus found there is a reduction on the price amounting to about 10*s.* on the pig. The animal is pickled, and such bacon is sold for about 3*s.* a flitch less than sound bacon. There is a similar reduction on the hams.

Measly bales of ham and bacon are regular articles of trade, and though sold but little in Ireland (where the disease is known), are largely exported for Glasgow, and other large towns in England and Scotland.

My most detailed inquiries on this subject were made in Cork and Waterford. In Cork I learned that large numbers of diseased pigs were sold and pickled.†

Waterford is famed for the production and exportation of bacon. I visited the market on the 20th of August 1862, and found a large show of very good pigs. A considerable per-centage of these were measly, and others indicated the early symptoms of the blue disease, or so-called hog cholera. The sellers of the pigs were in many

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* There are some ham and bacon factories in England and Scotland; but my observations have been almost exclusively restricted to Ireland.

† A gentleman of high standing in Cork told me that, requiring a parcel of hams for a friend, he had ordered them from a person in the town whom he thought the most respectable of tradesmen. Shortly afterwards he met an individual who told him he had suffered much from the cholera among his pigs, and had just been selling a lot. In answer to further inquiries, it transpired that these animals had been sold to the very person from whom the hams had been ordered. I need scarcely say that they were countermanded.

instances individuals driving one, two, or three to the market, but farmers and dealers had large numbers to offer to the bacon factors.*

Measle trying.

There are two very extensive bacon factories, and several smaller ones. The first kill from 1,400 to 1,800 pigs weekly, whilst some of the smaller factories kill as many score. The pigs are bought in twice weekly, and are kept in sties, on sawdust, without food for 48 hours. The object of this fast is to "harden the meat." The price varies from *4l.* to *5l.*, and a reduction is claimed on measly pigs. Before the animals are paid for, they are examined by a "measle trier," a man who proceeds to work with a short and stout stick, a penknife, and an assistant. The pig is caught by the hind legs, then by a fore one, and turned up, the stick is forced into the mouth, and turned down on the ground, with a knee placed upon it, inflicting pain, and bruising sadly the pig's upper jaw. The tongue is then drawn out, and wiped, and measles looked for or felt for beneath and at the root of the tongue. Sometime the measles are very apparent, but at other times they are deep in the flesh ; and as the seller often doubts the opinion of the "measle trier" when he is told that his pig is measly, it is the duty of the operator to cut into the tongue and draw out one or more of the cysticerci. The buyer takes 10*s.* or 1*l.* or more off the value of the pig, and the farmer is a considerable loser, when, to his disappointment, many in a lot are found measly. The pigs are sometimes bought at a certain price on condition that they are not examined for measles, and the buyer drives as hard a bargain as he can, and hopes they may all be healthy. The proportion of measly pigs varies much according to seasons, and according to the country from which the pigs are brought. A bacon-factor on a very large scale has favoured me with the following numbers, which refer to the killings of eight days in each of the last two years :—

	1861.			
	Number of Pigs killed on the given day.	Number found to be measly.	Number of Pigs killed on the given day.	Number found to be measly.
	354	8	161	3
	148	4	541	12
	286	6	498	17
	330	2	420	3
	437	6	300	8
	335	7	244	4
	373	17	234	4
	444	16	322	3
Total -	2,707	66	2,720	54
Average per cent.		2·47		1·98

One lot of 233 from county Waterford had not a single diseased one in it, and this is accounted for by the cleanliness and good feeding in this county as contrasted with the counties Limerick, Tipperary, and Kilkenny, from which the diseased pigs were obtained.

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* It is found that many more pigs than formerly are now bought from farmers, and consequently fewer obtained singly from the poorer classes, a difference which undoubtedly is one of sanitary improvement.

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I have been told by the greater pig-buyers that sometimes as many as 8 or 10 per cent. of the pigs bear indications of blood extravasations, generally due to the prevailing "hog cholera," but sometimes to ill-usage.

One of the most troublesome complaints the bacon-factors have to contend with is the foot and mouth distemper, or epizootic aphtha. It prevailed extensively in 1862 amongst the pigs as amongst sheep and cattle, and the animals are very lame, bleed from the toes, and lose their hoofs. The greatest cause of annoyance is that the sties become contaminated, and a lot of healthy pigs turned into them show the disease in 24 hours; they fret and lose flesh, and sometimes bleed so freely from the toes that it is found necessary to kill them, even during the night, it being a rule to destroy immediately any pigs which are taken with any illness during the time of waiting for ordinary slaughtering.

In examining the internal organs of a pig which I saw hung up, as recently slaughtered, I found the liver densely studded with echinococci, and was told that a very large number of the livers contained these parasites No estimate could be given me of the per-centage, but it was broadly stated as very much in excess of all diseased states put together.

In the Irish bacon factories the killing, singeing, and opening up a pig takes about three minutes. The animal is then examined for the measles, and as the Irish say that "every pig has its measle in it," attention is only paid to those cases in which the flesh is deteriorated by a large number of the parasites. The psoas muscles, and those of the neck, are divided to discover the measle. All the healthy pigs are branded; but the measly ones are not, "as they cannot do credit to any "establishment." In some cases where a measly pig had been branded by mistake, I saw the name scraped out again. The heads of the pigs being cut off, and the sides severed, they are deposited in pickle for several days; they are then pared and packed for shipping. During the packing process all the flitches are carefully but very rapidly tested with a prong, to ascertain if any are tainted, or, in other words, have in parts not absorbed the pickle. Any that are not perfect are sold as "tainted." The "measly" flitches are likewise packed by themselves, as also are the "red soldiers." In the trade these three kinds of damaged bacon are known as "measly," "tainted," and "bruised" flitches. The Irish prefer the two last to the first, but "measly" flitches sell readily in England, owing, it is supposed, to measles being to a great extent unknown in England. In the Irish markets tainted flitches are decidedly preferred to the measly ones. Some retailers order the latter specially, and all that Waterford can supply go to London.

Sausage manufactories.

I need not add to the many revolting, but true statements, that have from time to time transpired as to sausage factories. The cases very lately mentioned in the "Times," as reported by Dr. Letheby, are very similar to many I could relate. Dr. Letheby said: "The "inspectors inform me that much of the diseased meat of Newgate "Market finds its way to the sausage makers of Cow Cross. Last "week the inspectors seized the carcase of a diseased sheep and a "pig which were being carried to a sausage maker in that locality. "The sheep had died from rot, and the pig was covered with small "abscesses, like boils, many of which had burst through the skin, and "the rest were still full of matter. Both of these animals were in a "shockingly diseased state, and but for the interference of the inspec- "tors would have been converted into sausages. I have also to state

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" that the slaughter-houses of Cow Cross, which are just outside the " City, are a source of great anxiety to the inspectors, from the circumstance that diseased animals are frequently slaughtered there, " and brought into the City markets."

e. The Milk Trade.

At one time all the milk for London and similar cities was produced in or near such towns. Railways have now facilitated the conveyance of milk and butter from country dairies, and a considerable amount of fair milk is thus obtained in many of our large towns. But the country dairies supplying the cities are suffering severely from disease. Many of the extensive dairymen within a few hours' journey by rail from London experience losses as great as the dairymen in London, and they have assured me that in order to keep up their supplies they have to buy from all quarters. A member of an extensive firm in the City, engaged in the milk trade, told me during last summer that keeping cows as they did in the country, near Chelmsford, would be very profitable if they could keep away disease, but they found under existing circumstances that it paid best to keep a few cows, and buy milk wherever they could get it. *They could buy it cheaper from the small farmers than they could produce it.* This last fact struck me as verv singular on first hearing it, but it is easily explained. A dairy of 200 cows, such as these gentlemen usually have, calls for constant buying. The small farmers breed a few and buy less. The extensive dairyman loses much by contagious disease, and the small farmer very little, so that the latter can produce milk at a cheaper rate than the extensive dairyman. It is a fact that the most extensive dairies are those in which pleuro-pneumonia is most constantly raging. The small dairies, as a rule, arê the healthiest.

Town dairies.

Concerning the growth and management of town dairies I can furnish facts which indicate that there is no safer business in which to invest capital, and which explain how town dairymen have been enabled to keep up against heavy losses by disease. My experience has been gleaned in several large towns, but I am best acquainted with Edinburgh ; and I can safely state of the Edinburgh dairymen, that they do not adulterate their milk ; they do not water their milk to any extraordinary extent ; and a large number of the dairymen sell their milk precisely as it flows from the cow. Many will say that if this is true, they cannot bear up against losses by disease, but I can afford a very satisfactory explanation.

Dairymen start in business having gathered together a little money as farm servants, coachmen, porters, coal agents, or in any other employment. Many indeed start in the trade after having failed at another, but they never fail to make money with cows if they are at all prudent and intelligent. They constitute a class of people of economical habits, and with whom any money made is sure to accumulate. From two or four cows the number increases rapidly to eight, 10, 30, and 50. They begin by buying cheap cows as a rule, and end in purchasing nothing but the finest they can get.

The Ayrshire breed the most profitable.

It is quite a mistake to think that our town dairy cows are inferior in quality. They range in value from 12*l.* to 30*l.*, and I am not overstating their average value in Edinburgh at from 16*l.* to 18*l.* Formerly, Ayrshires were purchased, and the capital invested in them was much smaller than that now required to buy the heavy cows which carry plenty of flesh. If the animals could be kept healthy, the Ayrshires would be by far the most profitable, as they yield most milk in proportion to food consumed ; but whereas in former times, prior to the importation of foreign stock and foreign diseases, aged cows used to be purchased for the milk they would yield, and for that alone; now young fat cows are bought, to turn into ready cash when they are seized with disease. Old worn-out cows are never so fit. No attempt is made, as in former times, to keep a bull and breed from town dairy cows.

Frequent change of stock in town dairies.

The heavy short-horn cows, so much preferred by the Edinburgh dairyman, are bought with a knowledge of the fact that within two months, usually six weeks after entering the dairy, they are very likely to be seized with pleuro-pneumonia. All get the malady sooner or later, but some in a mild and often unperceived form, whereas 60 per cent. on an average have to be sold to the butcher about two or three months after their purchase. I know dairymen that keep 25 cows, who have to buy one weekly to keep up that number. Others, with 40 or 50 cows, who on an average buy two a week, and so on.

In one sense the rapid changes in the dairies are most advantageous to the dairyman. He has a stock constantly on hand yielding the largest possible amount of milk. For two months after calving a cow is worth very nearly twice as much as any two months after that period up to the time of her running dry. She will yield a profit of five or six shillings a day, selling her milk, as in Edinburgh, at fourpence a quart. Beyond this period she will not leave more than three or four shillings. It is evident that 50 cows, all within two months after calving, are worth as much to the dairyman as a stock of 80 or 90 cows that have calved from three to six months. No one could suppose the difference between newly calved and old calved cows if they had no experience in the matter.

In a town dairy an old calved cow does not yield enough to pay her keep; and if she has to be in two or three months whilst the secretion of milk is passing off, and she is laying on flesh for the butcher, it has been estimated that every pound weight of beef thus produced costs the dairyman two and sixpence.

Constant change of dairy stock profitable.

Contagious diseases have taught dairymen that there is the largest profit in a town dairy when the stock is not kept too long.

I have known one of our largest dairymen in Edinburgh go to the market and pay 50*l.* for a pair of fine short-horn cows in good condition. One was sold to the butcher diseased for 18*l.* six weeks after, and another eight weeks after for 15*l.* They had given the dairyman a profit of five shillings a head daily whilst they remained in health,—in the one case a total of 11*l.* 10*s.*, in the other, a total of 14*l.*; so that altogether the dairyman got from them an amount of 58*l.* 10*s.*, or a profit of 8*l.* 10*s.* on his purchase. Had these two cows lived, they would never have given in the next two months the same profit as two fresh cows in their place. Any man may accumulate capital at such a trade; and it is quite easy to understand what the largest dairyman in Edinburgh said to me a short time since, viz., "that nobody had "known how to make money out of cows until the disease came "amongst them."

The remarks made as to the improper food given to cows, the watery nature of that food, its tendency to develop disease are all based on hypotheses, and are quite devoid of foundation in fact.

The dairy cows of Edinburgh are fed on draff, millseeds, turnips, bean meal, oil-cake, and straw. They are fed well, and are not liable to disease induced by defect in the quality, and defect or excess in the quantity of food. Their manure is rich, and worth as much as 4*l.* 10*s.* yearly for each cow. This again proves how profitable cow-keeping is. There is no waste. It is all money. It does transpire, however,

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that to feed for making flesh in town does not pay, and the loss on the sale of diseased cows is perhaps more than counterbalanced by the advantage of always having fresh stock.

It cannot be wondered at then that the dairymen of Edinburgh have strenuously opposed any interference, and not believing in the possibility of preventing the maladies at present so destructive amongst their cows.

V.—THE EFFECTS ON THE HUMAN SUBJECT OF CONSUMING THE FLESH AND MILK OF DISEASED ANIMALS.

1. *Meat from diseased Animals.*

The public suffers in two ways from the sale of the flesh of disease animals.

In the first place it is defrauded, and the money paid for nutritious meat is exchanged for deteriorated produce.

In the second place the human health suffers from the consumption of the produce of diseased animals. This I can state on the authority of many of the most distinguished medical men in this country.

Professor Maclagan on the effects of diseased meat.

Professor Maclagan, of the University of Edinburgh, stated at a public meeting held in Edinburgh on the 29th of January 1862 that in his practice, both as a physician and a toxicologist, he had met with instances in which several persons had been attacked simultaneously with irritant symptoms after having in common partaken of meat which, on being examined, was found to contain no poison, nor to be in that state of putrescence which, as is well known, occasionally confers upon animal matters actively poisonous properties.

Dr. Taylor on unwholesome meat.

Dr. Alfred S. Taylor, F.R.S., in a letter addressed to me on the 12th of January 1863, says: “As a general principle I think diseased meat “ noxious and unfit for human food.” He moreover adds: “In the “ course of my practice I have met with several cases of poisoning “ which appeared to be attributable to diseased or decomposed meat, “ more frequently the latter. I can at present recall to my recollection “ only two fatal cases, one from diseased mutton, the sheep having had “ the staggers, and one from German sausages. Animal food has been “ frequently sent to me with a view to the detection of poison, the “ persons sending it having the impression that from the vomiting and “ purging produced, poison must have been mixed with it. No poison “ has, however, been found to justify this suspicion.”

Dr. Letheby on the injurious effects of diseased meat.

Dr. Letheby, writing to me on the 24th of January 1863, states: “ My opinion of the injurious effects of diseased meat on the health of “ those who make use of it is very decided. I have seen so much mis- “ chief from it, that I do not hesitate for one moment to say that some “ legislative measure is most pressingly wanted to prevent not only “ the traffic in diseased meat, but also to prevent the slaughtering of “ diseased animals. Such regulations are now in operation everywhere “ on the continent, and they are much needed here. In the City mar- “ kets alone my officers seize from one to two tons of diseased meat “ every week. Last year we seized 110,046 lbs. of meat, of which “ 78,697 lbs. were diseased, and 13,944 lbs. from animals that had died “ from disease. The year before we seized 141,458 lbs. of meat, of “ which 91,098 lbs. were diseased, and 33,619 lbs. from animals that “ had died. We often pursue the offenders into a court of justice, and “ have them fined or imprisoned, but I feel that the mischief should be “ stopped before it reaches the markets. Officers are wanted to examine “ the cattle before they are slaughtered. As to the effects of such “ meat on the human subject, I have seen many cases of illness from it.

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"One of these is sufficiently important to bring under your notice. "In the month of November 1860 a part of a diseased cow was bought "in Newgate Market. It came from one of the cow-houses of London. "It was bought by a sausage maker of Kingsland, and, as is commonly "the case with very bad meat, it was made up into sausages. Sixty-"six persons partook of the sausages, and 64 of them were made very "ill. They were purged, became sick, giddy, and the vital powers "were seriously prostrated, and they lay in many cases for hours in a "state of collapse, like people with cholera. One man died, and I was "requested by the coroner to inquire into the matter. I obtained "some of the sausages, thinking that a mineral poison might be pre-"sent, but I could discover none, and the whole history of the case "showed that it was diseased meat which had done the work. Again, "Dr. Livingstone tells us that whenever the natives of Africa eat "the flesh of an animal that has died from pleuro-pneumonia, no "matter how the flesh is cooked, they suffer from carbuncle. Now it "is a very remarkable fact that boils and carbuncles have been most "prevalent in this country for several years past. The Registrar-"General for Scotland has drawn attention to this fact."

Dr. Thomson on the effects of bad mutton.

Dr. R. D. Thomson, Medical Officer of Health for the parish of St. Marylebone, concurs in his views with the eminent authorities just quoted, and in support of his opinions has favoured me with the particulars of cases of injury from bad mutton. "A shopkeeper and wife, "two young men in the shop, and the female servant, partook of a "portion of mutton bought in Newgate Market on a Monday. The "mutton had a bad smell, was fat, and the fat possessed a dark colour. "One of the young men was attacked on Tuesday, at three in the "morning, with sickness and purging simultaneously, accompanied by "pain on both sides of the abdomen, burning heat and fever, with "headache; giddiness supervened on the Wednesday. Purging and "vomiting continued incessantly till Friday morning. The matter "vomited and passed by stool possessed an offensive odour and pale "colour. The active stage of fever continued for twelve hours from "the beginning of the attack, and was followed by typhoid symptoms "which increased steadily till Friday morning; the low fever affected "the patient a week from this period. The evacuations were tinged "with blood, and contained mucous matter on Thursday and Friday "morning. The contents of the stomach, which were very ammo-"niacal, were carefully examined for mineral and other poisons with-"out success. Herpes labialis made its appearance when convalescence "set in on the following Tuesday. The other young man was severely "attacked with similar symptoms throughout, with the exception of "the bloody stools and typhoid symptoms. The wife and servant were "also affected in a like manner for two days, and the husband for a "few hours. One of the connexions of the family who resided at some "distance, and who partook of the same carcase, was also similarly "attacked during 24 hours."

My own observations confirm the opinions of the eminent authorities just quoted. I have known in many instances where meat supplied to students in lodging-houses in this city has led to vomiting, purging, and severe colic. In the majority of instances such meat was cooked in the form of beef-steak. Three of my own students were affected simultaneously one day in December last. Within a couple of hours after dinner they experienced colicky pains, purging, vomiting, and these symptoms lasted several hours. Bread, potatoes, and water were the only other materials they had partaken of at dinner. On another occasion two were affected, but did not attribute the injury to the steak until the next day, when the servant ate what had been left of the meat and suffered severely. I am informed by Dr. Littlejohn, medical officer for the city of Edinburgh, that a respectable tradesman recently suffered so violently after eating meat that an inquiry was instituted, and the meat analyzed with a view to determine the existence of poison in it. None was detected.

The principles which render the flesh of animals deleterious may be classified as follows:—

a. Cadaveric venom.
b. Animal poisons, known from their effects in inducing specific diseases.
c. Organic poisons due to putrefaction.
d. Mineral and vegetable poisons absorbed into the system of animals.
e. Parasites.

A large number of cases are found recorded in the annals of science, demonstrating that all the principles classified as above are calculated to render meat unfit for human food.

For the purpose of this report I need only make a few remarks on the nature and effects of those deleterious principles.

a. Cadaveric Venom.

Cadaveric venom.

It is well known that wounds inflicted with an instrument used in the dissection of a human body are apt to be poisoned, and the results may be very serious and even fatal. A similar poison pervades the tissues of cattle that have been over-driven, of others exhausted by disease, of cows and other animals slaughtered after many hours' difficult labour, and of those dying from parturition fevers. This poison induces severe ecthyma if applied to the skin, and this very frequently occurs amongst veterinarians in this country. I have suffered repeatedly from eruption on both arms, and in one instance the general fever was so great as to confine me to bed. Several individuals attending the same animal have been affected in a similar manner. That eating the flesh of such animals has been attended with bad effects there is no doubt; and abroad attention is paid that animals be rested after travelling, that animals in labour or suffering from parturition fever should not be slaughtered, &c. The symptoms induced in man from eating of such carcases have been burning sensations in the stomach, violent colic, insatiable thirst, vertigo, excessive debility and partial paralysis, anxious expression of countenance, sunken eyes, small and frequent pulse, and in some instances death. The meat that has induced these symptoms was cooked. Butchers in this country very generally acknowledge the danger attending the eating of the flesh of a cow slaughtered either in difficult labour or suffering from milk fever. Several have informed me that they have known people injured by such food. The cadaveric venom is most potent in fresh meat, and it is destroyed by putrefaction. It is somewhat singular that it should develop in the dying animal prior to death.

b. Animal Poisons well known from their Effects in inducing specific contagious Diseases.

Of these poisons, the best known are those of anthrax, epizootic aphtha, and pleuro-pneumonia.

As to anthrax, we may accept Heusinger's statement as proved, that man often suffers from malignant pustule communicated to him by animals suffering from anthrax. Malignant pustule is by

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no means an unknown disease in the United Kingdom. Many cases have been recently recorded; and although a high temperature is usually essential for the development of the poison so as to render it virulent, its effects have been noticed in a whole family who partook of the flesh of an animal dying of black-quarter in Aberdeen. Dr. Keith has informed me of this, and of the fatal effects of the meat on two persons. Dr. Keith says that the deaths created a great sensation in the district at the time of their occurrence "and has hindered the "repetition of any similar occurrence, but it is to be feared it has also "led to the more early disposal of sick cattle for slaughter to be sent "off to some distant market." A number of cases have been related to me by different individuals, and especially one of 17 people being more or less severely affected in proportion to the amount of meat eaten. More than one death occurred in this instance, which happened a number of years ago in Dumfriesshire.

If the effects of diseased meat on man are traced with difficulty, owing to the manner in which such meat is distributed in our large towns, they are more readily traced in animals; and during the past year several observers, and especially Professor Simonds, and Mr. Aris of Wellingborough * have recorded observations to the effect that pigs and dogs eating the flesh or drinking the blood of cattle that have died of splenic apoplexy have died with symptoms of blood poisoning.

In reports on the health of stock for 1862 which I have just published, there is additional evidence as to the slaughter of animals affected with splenic apoplexy for human food, and the poisonous effects of the flesh of such animals on dogs, pigs, and ferrets. Pigs that have been seized with illness from eating the spleen of an ox that had died of the disease have been sent to market, whether after having succumbed naturally or purposely slaughtered, to avoid a natural death. In Ireland a Meath farmer told me that splenic apoplexy broke out amongst his stock last year, and he sent them as fast as seized to Dublin.

My inquiries abroad would lead me to believe that the cases of malignant pustule in man are not so much more frequent there than in this country as medical men have supposed. In proof of this I may refer to the number of cases recorded within the last few months in British Medical Journals, owing to the greater attention paid to the subject.

I find that abroad, as in Britain, the cases of malignant pustule are due more frequently to accidental inoculation than to eating the flesh of animals that die of anthrax. Indeed such flesh is not unfrequently eaten with impunity, or with the result of inducing simple diarrhœa.

Boils and carbuncles have been very common of late years, and this has been remarked by the Registrars General of England and Scotland. I have recently learned that at a convict establishment where diseased cattle are eaten in large quantities, and especially cattle affected with the lung disease, as many as 40 and 50 cases a month of boils and carbuncles occur amongst 1,520 convicts.

The poison of epizootic aphtha, well known to affect man, is capable of rendering the flesh of animals unwholesome. I have recently been favoured with the report of serious illness induced amongst a pack of fox hounds (fed as usually with boiled meat and oatmeal) from a cow being cooked for them that had died of epizootic aphtha; the hounds that partook of the meat were all violently purged.

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* Edinburgh Veterinary Review, March 1863.

c. Organic Poisons the Result of Decomposition.

These poisons, for they are various, develop especially when meat is pickled or made into sausages. Dr. Christison relates a case which occurred in the autumn of 1826, in which four adults and 10 children ate at dinner a stew made with meat taken from a dead calf found on the sea shore. Ill effects ensued after three hours. The symptoms were those of irritant poisoning, and one patient died. Dr. Christison attributed this to the flesh having undergone adipocerous decomposition. Many cases have been recorded showing that bacon and pork are apt to poison when eaten in a state of partial decay. Dr. Taylor says in his work on Poisons (2nd edition): "There is no doubt that partial "decay may render unwholesome and injurious the flesh of the most "healthy animal; and it is by no means improbable that among the "poor of large cities the secret sale of decomposed and unwholesome "meat is a very frequent cause of disease and death. What the nature "of the poison is which exerts such a virulent action on these occa-"sions we are quite unable to determine. Liebig imagines that it is "owing to the production of a fermenting principle, and that it operates "fatally by inducing a kind of fermentation in the animal body. It "has been said that the symptoms of irritant poisoning produced by "animal food seldom appear until five or six hours after the meal. "This may be generally true, but in certain instances it has undoubt-"edly happened that the symptoms have come on in from a quarter to "half an hour after the taking of the noxious food." I need not refer more particularly here to the sausage poison, cheese poison, &c., which so often induce bad effects on human beings abroad.

d. Mineral and Vegetable Poisons absorbed into the Systems of Animals.

I have frequently known animals slaughtered that had received large and repeated doses of purgative medicine, which had evidently accumulated in the system, because they had not induced purgation. I have especially noticed the cases in which croton oil had been administered. In other animals drugs had been given that are known to accumulate in the body, such as arsenic, and the potassio tartrate of antimony. During the past summer many cattle were treated for pleuro-pneumonia with arsenic and strychnine by an empiric in Perthshire, and some of the animals were slaughtered, and their carcases sent to Glasgow and London. A remarkable case was reported by Dr. Kreutzer in the Central Zeitung für die Gesammte Veterinärmedizin for 1854. Three hundred and one persons partook of the flesh of an ox that had been treated during life with potassio tartrate of antimony. Of these, 107 suffered from violent vomiting, purging, &c., and mothers that were suckling children noticed violent effects in their babies. The ox had not received more than a couple of ounces of tartarized antimony. One of the affected individuals died, and the cause of the attacks was demonstrated by chemical analysis of the flesh, and of the contents of the stomach and intestine of the person that succumbed. This person had eaten only half a pound of the meat. Pigs, dogs, and cats that partook of the meat also suffered. Some of the meat was given to a magpie, and it died.

It has been frequently remarked that human beings may manifest the symptoms of poisoning after eating the flesh of animals which have eaten poisonous principles without the animals themselves having been apparently affected. I need only add that this is observed in the cases of poisoning from eating American partridges, and in the malady

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known in America as the "trembles." The flesh of the cattle fed in some extensive districts of North America induces in those who make use of it symptoms of aggravated cholera morbus.

e. *Parasites.*

The flesh of animals affected with parasitic diseases is probably the most constant source of parasitic disease in man. Bad effects have been witnessed from the carcases of animals being used that have contained parasites belonging to any of the varieties, whether hydatids, tapeworms, round or sucking worms. These effects are due to the migration of the parasites, with the exception of one instance, viz., the influence of using the flesh of rotten sheep. Ill effects have been witnessed when human beings have eaten the flesh of sheep whose liver indicated the existence of distoma hepaticum as the specific cause of rot. This has been attributed to the rapid putrefaction of the carcases. Professor Simonds says: "We have on more than one occasion known " persons to be taken seriously ill when engaged in opening many " rotten sheep at a time. A remarkable instance, not only of sickness, " but of death, was brought to our notice in August 1854. A person " of intemperate habits, following the occupation of a country butcher, " was employed in skinning and dressing a number of rotten sheep on " the premises of a farmer in the county of Norfolk. The sheep were " necessarily opened when warm, and while he was so engaged he " complained greatly of the sickening smell; the same evening he was " attacked with choleraic disease, and two days afterwards was a " corpse."

Referring in the next place to hydatids and tape-worms, I may notice in the first place the common disease of sheep termed gid, staggers, turnsick, &c. It is due to cœnurus cerebralis which develops in the brain. Mr. Donaldson Thompson, one of the most intelligent veterinary students I have ever known, informed me of a singular case, in which a farmer and his wife suffered severely from tapeworm, which they referred to eating the heads of many sheep, during a season of great mortality amongst these animals.

Dr. Taylor publishes the account of a case in which a shepherd, his wife, son, and daughter suffered after dining on some mutton. One of the children died. The sheep had been killed because affected with staggers, but the effects which its flesh induced were attributed to its decayed state when eaten.

There is a constant conflict between the causes favourable to the multiplication of parasites and the influences which protect men and animals from the invasion of such dangerous foes, and it is our duty to favour the latter influences and destroy the germs of worms under whatever circumstances they may be attacked.

Number of measly pigs in Ireland.

It is stated by the persons of most extensive experience in this matter in Ireland, that at least 3 per cent., but probably 5 per cent. of the Irish pigs are measly. Assuming that the smaller number is the correct one (*see* chapter on the *Pig Trade*), it is evident that of the 1,151,785 pigs in that country, there are certainly 34,550 measly ones. Taking old and young, those fit for the butcher, and those that are not, I am quite confident that there are between 40,000 and 50,000 measly pigs in Ireland.

Number of human beings in the United Kingdom affected with tænia solium.

We are told that the measly pigs are principally consumed in England and Scotland. London and Glasgow seem to be the towns that consume the largest number of them in the shape of ham, bacon, sausages, and even without such preparation. My impression is that for every measly pig in the United Kingdom there is at least one

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human being with tapeworms; but supposing there is one for every other measly pig, that would give 17,275 individuals afflicted with that most troublesome complaint, tænia in the intestine, or one person in a little under 2,000 people.

Dr. Haldane on the prevalence of tapeworm.

Dr. D. R. Haldane, who has great experience as to the prevalence of parasitic diseases in man, in consequence of the very large number of post-mortems performed by him with great care in the Edinburgh Infirmary, writes me as follows: "So far as my experience goes, you " do not over-estimate the frequency of tapeworms in stating it at " one in 2,000 people. Edinburgh is generally considered to be com-" paratively free from parasitic disease, but I have found a tapeworm " three if not four times in the bodies of the 2,000 individuals I have " dissected. This is fully borne out by what I have met in dispensary " and hospital practice during the last 10 years."

Bateman on the prevalence of tænia.

Bateman states that he had a case of tænia solium for every 543 patients, bearing out in a singular manner Dr. Haldane's experience.

Several tæniæ may exist in one human being.

Tænia solium does not occur at all times singly. Two and three such parasites in one individual are not, says Leuckart, amongst the rarities. From six to ten specimens may be obtained from one case, and exceptional instances many more.

Injurious effects of the presence of tænia solium in the human intestine.

These parasites may not kill human beings directly, but favour the development of fatal disease. Seeger Wundt, quoted by Kuchemeister and Weinland, says: "Of a 100 men who were afflicted with the tape-" worm, there were 68 suffering from cerebro-spinal affections, and " partial or general convulsions (for example, epilepsy, hysteria, " melancholy, hypochondria, abdominal spasms, dyspnœa, convulsions, " and short coughing), which may even rise to maniacal attacks, and " mental weakness; 49 from nausea, even with vomiting and fainting; " 42 from various pains in the abdomen; 33 from disordered digestion " and irregular evacuations; 31 from irregular appetite and voracity; " 19 from periodical or habitual headache, usually on one side; 17 " from sudden colic; 16 from undulatory movements in the abdomen " up to the chest; 15 from dizziness, or illusions of the senses, and " defects in the speech; and 11 from shifting pains in various parts of " the body."

Dr. Keith, of Aberdeen, writing on the 22nd of May 1863, says:— " Tapeworm is not common here, yet I had a case last month in the " person of a butcher lad, who being slightly asthmatic, ate raw flesh " in conformity with a notion prevalent among butchers that it " 'strengthens their wind.' He came in the belief he was dying of " consumption, being wasted to a skeleton, and having a very dis-" tressing cough. The stethescope revealing nothing very far amiss " with the lungs, I pushed my inquiries, and found out that small " bodies dropped from his anus occasionally. One drachm of the " essential oil of male fern brought off three yards of tapeworm, and a " second dose the entire parasite, head and all. The cough left him " as if by a charm, and now he is fat and strong."

Measles in man.

Notwithstanding the very unpleasant symptoms induced by tapeworm in man, they are exceeded in danger by the occasional penetration of the germs of the same parasite into the muscles and internal organs of human beings, inducing a disease identical with measles in the pig. Leuckart quotes many observations of this description, but as it is my object simply to show the importance of a careful study, and adopting means for the prevention of measles in the pig, I shall content myself with a quotation on the subject from Dr. Weinland's Essay on Tapeworms in Man. Under the head *Protection from the Hydatid of Tænia solium*, he says: "This is perhaps the

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" most important point for the physician, for though the tapeworm in " the intestine is certainly troublesome, yet it never seems to be really " dangerous, at any rate, not so much as its larva." This, as stated above, occasionally finds its way into man, not into his intestine, but into the muscles and other tissues, and even into the brain, mostly in places where no physician can tell its presence, and where no surgical knife or medicinal remedy can reach. It has produced death in some cases. We have seen that, when man accidentally swallows the eggs of *Tænia solium*, the embryos hatching from these eggs in the stomach come into circulation, &c., just as in the hog. It is evident that this might happen in drinking water or in eating fruits which have lain on the ground, or salad made of lettuce, particularly when this latter, as is sometimes the case, is manured with night soil. We have observed above, that from time to time the proglottides of the worm pass away from the patient, that they are sometimes found in their beds, &c., and that they are teeming with eggs, which become spread about. It might easily happen that one or even many of these eggs should by accident reach the stomach. This is the true danger for the person afflicted with the tapeworm, or for those about him. The worm that lives in his intestine cannot do much injury, but from its eggs he and others may become infested with hydatids.

Hydatids in man.

In making inquiries as to the frequency of hydatids in the pig amongst the ham and bacon factors in Ireland, I was told that the number of cases of hydatids in these animals exceed by far the numbers of cases of all other diseases put together. This season the destruction by these parasites has been great.

Under these circumstances it is not unimportant that I should notice a statement of Leuckart. He says: "Amongst the human parasites " there are no others which can be compared for the manifold conditions " under which they appear with these hydatids. Even cysticercus " cellulosæ, which we regard as the most widely spread parasite, is " behind the echinococcus in the number of organs it attacks. There is " scarcely an organ in the human body which is not occasionally the " abode of the latter parasite. Even the bones are at times wounded " by it."

The ravages committed by echinococci are great in Egypt, America, and especially in Iceland. In large towns the parasite does not prevail to such an extent as in the country. According to Busk it is more frequent in the poor than in the rich. It is very rare in Scotland, more frequent in England, and most in Ireland.

Cases of hydatid disease are now more frequently recorded, and much information on this subject is to be found in Davaine's work on Entozoa and Frerich's on the Liver.

It is very probable that the embryos of these hydatids are swallowed by human beings in water, on vegetables and other substances which have accidentally received on their surface the ova of tænia echinococcus. It is important to diminish as much as possible the number of germs, as these hydatids multiply rapidly in the bodies of their victims. From the frequency with which echinococci must be eaten by dogs about slaughter-houses, and the many ways in which germs from canine tapeworms can penetrate the body, it is rather astonishing that, though the number of cases of hydatids in man is by no means small in this country, it should not be much greater.

Trichina spiralis the cause of death in a human being.

Professor Zenker, of Dresden, reported the following case in 1860: " On January 12th, 1860, a robust maid servant, 24 years of age, was " admitted into the Dresden Hospital. She had been indisposed since " Christmas, and confined to bed since New Year's day, complaining of

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depression, lassitude, sleeplessness, loss of appetite, heat, and thirst. “ These symptoms persisted on her admission ; there was considerable “ pyrexia ; the abdomen painful and tympanitic ; and although neither “ splenic tumour nor roseola were present, the case was put down as “ one of typhoid fever. A remarkable affection of the whole muscular “ system now rapidly supervened, consisting in extreme painful“ ness of the extremities, with contractions of knee and elbow joints, “ and œdematous swelling, particularly of the legs. The pain was so “ severe that the patient was continually moaning. Pneumonic “ symptoms supervened, and death took place on the 27th instant, “ preceded for 24 hours by an apathetic condition. The *post*-“ *mortem* examination showed in the internal organs merely an atelec“ tatic condition of the left lung, with numerous small lobular “ infiltrations, bronchitis, and hyperæmia of the mucous lining of the “ ileum. The muscles, however, which showed a greyish red colour, “ and a slightly freckled appearance, were found on microscopic “ examination to harbour vast number of non-capsulated trichinæ. “ The parasites were living, some coiled in spirals, others with ex“ tended bodies ; and all (as Professor Virchow was the first to show “ in a fragment of muscle, which was forwarded to him for exami“ nation) living within the sarcolemma of the primitive fibrils. They “ showed various stages of development ; they were diffused over all “ the striated muscles of the body, with exception of the heart, and “ that in such vast numbers that, under a small magnifying power, “ as many as 20 were in the field of vision simultaneously. “ The muscular substance was otherwise fragile, homogeneous, non“ striated, and showed numerous transverse fissures. The intestinal “ mucous was found to be swarming with mature trichinæ of both “ sexes ; and the remarkable fact was elicited, that female trichinæ “ are viviparous ; the central portion of the bodies being observed “ to be full of well-developed embryos.”

Inquiry being directed to the probable source of the affection, it was ascertained that on December 21, four days before the patient was taken ill, two pigs and an ox had been slaughtered in the establishment of her master. Some smoked ham and sausage, prepared from the meat of one of the pigs, were fortunately obtained, and on examination proved to be full of trichinæ. The parasites had a shrunken appearance, otherwise unchanged ; re-assumed a normal appearance on addition of water ; but showed no signs of vitality. It is particularly worthy of remark that to the naked eye the ham appeared perfectly healthy. It is very likely that the deceased had partaken of some of the raw meat. The butcher of the establishment (butchers notoriously indulge in raw meat) had also been taken seriously ill a short time afterwards, and was confined to his bed for three weeks with severe muscular pains, his whole body being semi-paralytic, &c. This complaint was ascribed to rheumatism at the time, but Professor Zenker correctly *surmises* that an immigration of trichinæ not sufficiently extensive to prove fatal may have been the cause of the attack ; and that capsulated trichinæ would very likely be discoverable in his muscle. Professor Virchow immediately commenced a series of feeding experiments with the pieces of human muscle forwarded to him by Professor Zenker.

Since Professor Zenker's case was recorded, many others have been seen.

Kuchenmeister, in 1861, said, with regard to attacks of trichinæ in man, that “ patients thus affected are in a sub-typhoid condition, but “ neither diarrhœa, nor typhoid eruption, nor any notable enlargement

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"of the spleen is present; they experience violent muscular pains on "the least movement; sometimes dysphagia, hoarseness, and strabismus, or a very limited mobility of the eye-ball are observed. If "such symptoms are present, the muscular tissue of the patient should "be microscopically examined. The treatment is to consist of purgatives, frequent and small doses of ol. tereb., with powdered fern "root."

I have noticed under the general head "Parasitic Diseases" the way in which trichinæ do injure according to Dr. Leuckart. It is very startling to learn that a dangerous and fatal enteritis may be induced by the mere act of piercing through the coats of the intestines, which is the method adopted by trichinæ to reach our insides and take up their abode there.

Leuckart in his new work affords us the unwelcome intelligence that trichinæ resist external influences calculated to destroy all other parasites. He says: "Die Trichinen sind überhaupt von allen mir "bekannten Helminthen am resistentesten gegen äussere Einflüsse." He has found them to resist intense heat of summer and the most bitter cold in winter for days. Putrefied muscle in summer contains *living* trichinæ. Ham and sausage, notwithstanding the processes to which they are subjected in being prepared, contain living trichinæ. Hams that have been smoked contain trichinæ capable of penetrating the tissues of man. Leuckart says, "Uebrigens werden auch die Trichinen "den Process der Räucherung voraussichtlich nur dann überstehen, "wenn dieser innerhalb bestimmter Grenzen bleibt. Im völlig "durchräucherten Zustande ist wahrscheinlicher Weise weder Schinken "noch Wurst im stande, die frühern parasiten an einen neuen Wirth "zu übertragen. Die Rindenschicht des geräucherten trichinenfleisches erwies sich wenigstens als durchaus unschädlich."

Leuckart adds: "If in the course of these observations I have "chiefly held pork in view, it is because human entozoa are found "in their young condition more amongst pigs than all other animals "slaughtered. We do not wish to vindicate for all the animals we "eat an absolute harmlessness; and, indeed, this we can do so much "the less, since we know that other mammalia may contain the cysticerci "and trichinæ such as are so frequently seen in pigs."

I can state on my own authority that less attention, *if possible*, is paid to diseased pigs slaughtered than any other animals; and I am confident that the more the subject of parasitism is studied, the more will it be found necessary to have well-trained veterinarians to inspect wherever slaughtering for human food is carried on.*

Sale of measly and trichinatous pigs must be prohibited.

The most recent information afforded us by Professor Leuckart clearly indicates that man's life is in danger if we do not prohibit the sale of measly and trichinatous pigs. It is quite evident that inspectors of such meats must be helminthologists.

2. *Milk from diseased Animals.*

The unhealthy condition of the large majority of stocks supplying milk for our large towns renders the question as to the wholesome or unwholesome character of the milk of diseased animals a very important one. Cows' milk has been known to acquire the properties of an irritant poison. This has been due to contact with metals, which, with the lactic acid of the milk, have formed poisonous compounds; but

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* Since the above has been written, a case has appeared in the Glasgow Medical Journal, January 1863, of poisoning by measly pork. The history of the case is not unlike those of instances of death from trichinatous flesh.

independently of any poison introduced in the milk, this secretion from an animal in a sickly condition has induced colic, thirst, diarrhœa, vomiting, and fever.

Cows, goats, and other animals yielding milk may take medicines or eat poisonous plants which render the milk poisonous. This is well known to occur abroad, and especially in Malta. In America likewise cattle eating poisonous plants yield milk that proves poisonous if partaken of by human beings.

There is no doubt, however, that the cause at present operating most actively to deteriorate the milk of cows in this country is the prevalence of epizootic aphtha. This disease attacks the human subject, and many cases of communication from cattle to man have been observed either from the virus penetrating a wound or passing into the system with the milk.

Valentini's observations in 1695.

Valentini noticed as far back as 1695 the existence of this disorder amongst cattle in Hesse, and at the same time spoke of aphtha as prevailing amongst human beings. He says: "Sub æquinoctio autumnali, " Augusto decrepito, inflammatio gingivarum, linguæ et oris in hominibus, in brutis verum pedum inflammationes observavi hinc inde." In 1707 the disease was described as existing in Franconia, and in 1708 in Silesia and Poland. Steurlin says with regard to the disease in Franconia: "Idem malum (epizootic aphtha) ex impuritate maligna " seri simili affecit modo dispositos, præsertim juniores homines quos-" dam cum deliriis, quosdam absque deliriis, omnes vero febre ca-" tarrhali maligna vires et partes citissime consumente."*

Disease from 1763–1764.

Sagar's observations.

Epizootic aphtha prevailed frequently after this period, but little is written on the subject until 1763 and 1764. Aphthous disorders and gangrenous anginæ were very rife amongst cattle, and also amongst human beings at this period. They were widely distributed over the European continent, and Sagar specially mentions a severe outbreak of epizootic aphtha amongst the domestic animals, and communicated to human beings. As Sagar's observations on this subject have been frequently quoted, I may here add his own words. He says: "Id præ-" terea rarum fuit in hic aphthis, quod canes, cati, gallinaceum genus, " ac homines ipsi ex usu lactis mulsi, initio aut in convalescentia ex " uberibus vaccarum hoc malo affectarum, morbum contraxerint, qui " eundem fere, quem in vaccis servabat decursum, præter quod tu-" moribus ad talos, eorundemque effectibus caruerint hæc animalia. " Hominibus pluribus qui dicto modo aphthas hæreditarunt ipse ego " medicinam feci, et morbi decursum exactissime observavi. Quorum " præcipua symptomata erant, deglutitio difficilis tum solidorum tum " liquidorum, calorem præterea questi sunt, et ardorem faucium " magnum. Conventus quidam virorum religiosorum totus hoc morbo, " ne unico fere excepto indubie ex usu lacticiniorum, afficiebatur."†

Disease from 1809–1812.

Heusinger's remarks.

No special notice of this disease was published until the beginning of the present century. It was very prevalent in the years from 1809 to 1812. Heusinger publishes the details of an outbreak spreading through Europe from east to west in 1817. It was also severe in 1824, and several Italian authors then wrote on it. In 1827 the malady committed much damage in various parts of Europe, and in Bohemia the disease was noticed amongst the people. Referring to this subject,

Nadherny's remarks on the outbreak of 1827.

Nadherny says: "Hier verdient die Thatsache angefürht zu werden, " dass zu eben der zeit, als die *Maul und Klauen-seuche* unter den *Rin-* " *dern* am meisten verbreitet herrschte, besonders jüngere *menschen*

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* Ephem. Nat. Curios. Cent. i. et ii., p. 156.

† M. Sagar de Aphthis Pecorinis anni 1764. Viennæ, 1765 et 1768–9.

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"von einem *entzündlich rheumatischen fieber* befallen wurden welches "sich mit einem *aphthösen Ausschlage in Munde*, oder einem blatter-"änlichen Exantheme, so wie mit Abscessen und Geschwüren an den "untern Gliedmassen entschied."* There can be no doubt as to the disease in men being the same "*maladie aphthongulaire*" then affecting the cattle, and, singularly enough, in 1828 similar observations were made in Styria. Levitsky, referring to the above outbreak, says: "Eine ähnliche Beobachtung machte ich im Herbste des Jahres in "physicats districte Vortsberg in Steyernach wo die maul- und "klauenseuche unter dem Hornvieh der Marktes köflach epizootisch "herrschte."

Kolb on the malady in 1827.

Kolb, in describing an outbreak in Wirtemberg in 1827, says: "Aphthæ et claudicatio simul ut plurimum bestias invaserunt;" and adds: "*Lac potum in infantibus pluribus vomitum acidum et diarrhœam ciebat.*"

Observations in 1834.

In 1834 the foot and mouth disease rapidly travelled through Podolia *from east to west*, and Heusinger specially remarks that England escaped, as it had done in every previous outbreak. At this time repeated observations were made as to the communication of the disease from animals to men. Hertwig performed experiments at Berlin, and many cases were reported as having been witnessed in France.

Continued spread of the disease in Europe from 1834 to 1840 and 1841. Dr. Reuscher on epizootic aphtha in the human subject.

From 1834 to 1840 and 1841, the disease continued to prevail over the European continent. It was very rife in Poland, Eastern Prussia, Hungary, Pomerania, and spread up through Hanover and Saxony to Belgium, Holland, and Great Britain. Numerous were the observations then of the disease in the human subject. Dr. Reuscher, of Stendal, says: "Gleichzeitig mit dieser seuche kamen auch häufig mund affec-"tionen, so wohl bei erwachsenen als bei kindern vor." Hildebrand quotes a large number of cases, and much information may be obtained in the second volume of Heusinger's "Recherches de Pathologie Comparée," page 496.

Attacks amongst human beings in 1839.

In 1839 the malady was very severe, and its attacks amongst human beings were especially observed. Thus we find in the archives of the Swiss veterinarians: "Hingegen beobachteten wir an verflossenen "jahre, wo die maul und klanenseuche in Schweizerischen Hochlande "herrschte, häufige übertragung auf menschen."

During the first year of the prevalence of the foot and mouth disease in this country, it was observed that human beings suffered from it, and this fact was brought under the notice of the Royal Agricultural Society of England. Facts were published by Mr. Kaerkeek, of Truro, Mr. Holmes, and other veterinarians. Little attention has been paid to the subject, and it has been only since my efforts to draw attention to it that further observations have been recorded. One of the students of the new Veterinary College, Mr. Watson, saw the disease amongst the children on a farm last summer, and many cases have come to my knowledge of late. There is no doubt that the disease may prove fatal in children, as it proves fatal in calves and pigs. In the February number of the "Edinburgh Medical Journal," two severe cases are recorded as having occurred in adults in Renfrewshire.

Milk is occasionally poisonous when derived from animals suffering from anthrax, but there are no facts to prove that it has proved injurious under such circumstances in this country.

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* Oesterreich, Med. Jahrbb. xi. p. 83, and Heusinger, Recherches de Pathologie Compareé. Cassel, 1853.

V. The Cotton Famine.

V.—REPORTS relating to the SANITARY CONDITION of the COTTON TOWNS of LANCASHIRE and CHESHIRE.

1. Health of operatives. By Dr. Buchanan.

1.—DR. BUCHANAN'S REPORT (Dec. 30, 1862) on the HEALTH of the OPERATIVES, as affected by the prevailing Distress.

THE following is my report of the results of the inquiry which, pursuant to instructions, I have for two months been engaged in making into the sanitary state and circumstances of the principal distressed cotton towns in the north of England.

Want of employment.

A population of 2,000,000 has been for several months cut off from an adequate supply of the material on which their prosperity depends. Nearly half a million of them are comprised in the class of cotton operatives; and another half million at the least may be taken to be directly dependent on their earnings. The welfare of the remaining half of the population is to a great extent involved in the fortune of their neighbours. Of the half million of cotton workers, as nearly as possible 50 per cent. are estimated to be quite out of employ; and of the others, 33½ per cent. are working at short time, while 16½ per cent. only are at full work.

Taking the cotton districts as a whole, therefore, their state may be thus exhibited. Of every 24 persons, six are cotton workers, who habitually support other six. Of the six cotton workers, three are now earning nothing, two are earning part wages, one only is at full work. Of the six persons dependent on them, one only could now be supported up to the ordinary mark. The remaining 12 persons, whose welfare is indirectly dependent on the cotton trade, will consist of about four persons who are earning, seven who are dependent on those four, and perhaps one who is a pauper. Of the four who are earning, it is safe to say that only two have their usual incomes. One cotton worker then, and two other persons, or three in all, are the only people out of the 24 who retain their full power of earning.

Relief of distress.

To the people who are rendered destitute by this enforced idleness assistance has been given, not only by the ordinary machinery of parochial relief, but by an organisation which for its magnitude and promptness, its spontaneity and general wisdom, is probably without any parallel. While the poor's rates are giving the means of subsistence to some 110,000 persons, it is estimated that the relief committees are supporting 170,000, and that another number of 160,000 is receiving assistance from both these sources. Nor does this total of 440,000 represent the whole number of persons receiving relief. Private charity has enabled a further considerable number to make no appearance among the recipients of public aid.

Typhus fever.

Yet in spite of the vast efforts made to assist the unemployed, one of the most lamentable consequences of extreme destitution has made its appearance. The prosperous cotton towns of Lancashire * have been wholly exempt from typhus fever (of the true Irish type) since 1847–8, when it prevailed epidemically, and was fatal to an extent only exceeded among the starving population of Ireland. In the present year this steady follower on famine has again appeared, and in Preston and Manchester has assumed an epidemic form. Rare cases of the summer

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* With, perhaps, the exception of Manchester. Liverpool is not counted among the cotton towns.

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1. Health of operatives. By Dr. Buchanan.

have multiplied to scores in the autumn. At Preston 227 cases of this fever are known to have occurred between midsummer and the end of November; and those attacked have died at the rate of about 23 per cent. In Manchester there have probably been at least 100 attacks and 20 deaths in the same period. In some other towns scattered cases of the same disease appear to have been seen.

Need of further inquiry.

The existence of typhus fever suggests by itself doubts as to the complete success of the measures that have been adopted for the relief of the distress. But on inquiry being made into the circumstances under which this disease prevailed in Preston and elsewhere, the existence of other morbid conditions was detected which tended to corroborate such doubts. Some of these conditions consisted in a simple decline from the normal standard of health and strength, while others constituted positive disease. For example, stray cases of scurvy attracted attention at an early period.

Nature of inquiry.

Special inquiry has therefore been made (Part I.) into the nature, degree, and localization of any morbid conditions affecting the distressed communities. With reference to these the amount and nature of the sustenance of the poor has been investigated, and peculiarities in their domestic state and habits have been noted (Part II.) in so far as they have appeared to bear on strength and health. This inquiry * has embraced observations as to the general vital state of the people by myself and by thirty medical practitioners holding public appointments; the collection of information from boards of guardians and relief committees in twelve of the principal cotton towns, and in some cases conferences with the local sanitary authorities.

I. Concerning existing morbid conditions related to distress.

PART I.

The following were the towns visited :—

Ashton.	Chorley.	Preston.
Blackburn.	Darwen.†	Salford.
Bolton.	Manchester, city.	Stockport.
Bury.	Oldham	Wigan.

Certain morbid conditions, such as are not accounted for by climatic peculiarities, have been discovered to exist in the cotton districts with exceptional intensity at the present season.‡ These will be usefully

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* Towns in which there has been typhus fever, or rumours of it, have received the largest share of attention.

† Darwen was visited on account of a special outbreak of typhoid fever. It is not throughout included in the statements of this report, but only where its experience threw light on some particular point.

‡ It is difficult to say positively whether or not there has been an unusual total amount of disease in the cotton towns. The union medical officers have on their books almost universally an increased number of patients; in some cases even 10 times as many as in the corresponding months of 1861. Similar calls are made on the public dispensaries. But in the main this increase only follows the increase in poverty, and perhaps, as a rule, the numbers who are getting public medical relief have not risen in the proportion of the numbers who are getting other public charity.

The deaths from all causes in the 12 unions visited have shown the following variations in the last six September quarters:—

1857.	1858.	1859.	1860.	1861.	Average of 5 years.	1862.
8,912	8,576	7,852	7,229	9,197	8,353	7,427

classified according as they are likely to be connected, with an especial prevalence of the following, viz. :—

A, with insufficient or innutritious diet.
B, with cold, exposure, bad ventilation.
C, with special want of cleanliness in and about houses and persons.
D, with the above influences in combination ; herein epidemics.
E, with moral peculiarities engendered by the distress.

A. Connected with insufficient diet, &c

Under the head A is first to be noticed a loss of strength, colour, and flesh among the cotton workers as a body. In all the towns visited, with the exception of Bolton and Bury, these conditions have attracted the notice of medical men.* Those who have charge of the poorer districts have noticed this deterioration more than others. Universal emaciation and pallor do not indeed at first strike a visitor to these towns. The girls in the sewing schools do not as a body present much contrast to those still at work in the mills. But when the visitor penetrates into the homes of the poor, he observes a very different standard of health. There is a wan and haggard look about the people, that he will hear from those who know them well is nowise habitual to them. He may see for himself the truth of an observation constantly made by the medical men, that the parents have lost their health much more generally than the children, and particularly that the mothers, who most of all starve themselves, have got pale and emaciated. At Ashton was added the testimony that mothers have become weaker in childbirth and faint readily from any excess of hæmorrhage at that time. Lactation has been noticed to be unwisely prolonged, the mothers pleading inability to purchase the food appropriate for a weaned child. Actual anæmia has been found prevalent in some places.

Asthenia.

Children appear to have suffered less in their strength and apparent robustness. Rickets and tuberculous disease among them have not appeared with any special frequency, unless it be at Preston and Stockport. Some practitioners are in expectation of an increase in these maladies, — in existing children, from prolonged suckling and from want of milk after weaning, and in children yet to be born, from the debility of their parents. On the other hand, one main cause of rickets, the injudicious hand feeding of children who ought to be at the breast, is probably less active now the mothers are at home instead of working at factory.

In almost every town a generally asthenic type of disease peculiar to the present season has been observed by those practitioners who are brought most in contact with the diseased poor. This has been most conspicuous in Preston, and also notably in Ashton, Oldham, and

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The death rate of 1862 may be considered as practically identical with the lowest death rate in 1860, remembering that the population has been increasing. But in both these years an exceptionally cold wet summer has influenced the mortality. In England, as a whole, however, the subsidence of mortality in 1862 was not to the degree of 1860. It may therefore be inferred that the mortality of the cotton towns last September quarter was low to a peculiar degree. The same cannot be said for the colder quarter ending March 1862, when the mortality of these towns was high. It is from the experience of the last cold quarter, and not from the summer of 1862, that we should most safely predict the rate of mortality for the ensuing winter.

* Perhaps no better single evidence as to the above fact could be had than the statement of the late resident medical officer of the Manchester workhouse, who has recently been appointed to the charge of a district almost exclusively inhabited by cotton workers. Between the habitual paupers of the workhouse and the thriving operatives of Ancoats it was to be expected that some difference would have been observable in respect of constitutional state and of resistance to disease. But in truth an experienced medical eye could draw no present distinction between the two classes.

Stockport. It has been least noticed in Bolton, Bury, Manchester, and Wigan. In the four first mentioned towns, among others, an unusual quantity of stimulant has lately been found necessary in the treatment of disease in general. Practitioners in Preston, Blackburn, and Oldham have remarked that antimony is particularly ill borne, and at Preston a singular facility to salivation by mercury has been noted. This was also mentioned in Salford.

Diarrhœa.

In the town of Preston, through the summer and autumn, there has been a large excess of diarrhœa beyond what is usual in other years, and the disease has been especially intractable. In no other town has any such excess been observed. In Ashton, Blackburn, Bolton, Bury, and Stockport there has been far less autumnal diarrhœa than usual.* Cases of dysentery, in no great number, yet still of exceptional frequency, have been seen in Chorley, Oldham, Salford, and Wigan. Diarrhœa has been a constant concomitant of measles at Ashton and Chorley. Except in these towns no prevalent disease has been actually complicated by it.

Hæmorrhage.

A hæmorrhagic tendency has been witnessed in several towns; actual scurvy has been seen among cotton workers in Stockport, Preston, Blackburn, and Salford. Almost all the cases were in women. Purpura has given a few cases in many of the towns; the largest number appearing to have been in Preston, Blackburn, and Stockport. No special disposition to hæmorrhage has been noted as a complication of ordinary disease, with a few exceptions. At Preston and Oldham practitioners have observed that (without mercury) the gums are apt to be swollen and bleeding. Blood in the stools in ordinary diarrhœa and the hæmoptoic tendency in phthisis were spoken of by one or two practitioners as being more than usually noticeable.

Ulcer.

A disposition to ulcerate or slough, apparently in consequence of altered diet and habits, has been observed in one or two cases in Blackburn; but by no one with any frequency, except by one district surgeon in Manchester, who says that in his practice all bruises and slight wounds are singularly difficult to heal. In Ashton, Chorley, Manchester, and Salford cases of bullous skin-disease, pemphigus and the like, were mentioned as of peculiar occurrence. Boils and carbuncles have been of their usual prevalence in all the towns, except that they were thought to be in excess in parts of Preston and Salford. Ulceration of the cornea was inquired for, but was only heard of with special prevalence at the Manchester Children's Hospital and the Salford Dispensary. To a less, though perhaps an unusual, degree, it has been seen in Wigan and Oldham. Ophthalmia has not existed with such frequency as to call for special remark, except in complicating measles in Chorley, in the families of the unemployed. At Oldham ophthalmia was common in a similar class of persons. In Wigan and Preston respectively, one practitioner has found it very common, but not among the cotton workers so much as in the families of Irish labourers.

B. Connected with cold, bad air, &c.

B. Inquiring next into the existence of exceptional morbid conditions of a sort to be dependent on cold, exposure, or bad ventilation, phthisis and lung disease chiefly present themselves for consideration. Phthisis is habitually in excess among cotton operatives, owing to their peculiar industrial circumstances. It is too early in the history of the distress to expect even a vague answer to the question, Is phthisis being generated with exceptional frequency under the new conditions under

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* In England at large diarrhœa has produced fewer deaths in 1862 than in average years.

V. The Cotton Famine.

1. Health of operatives. By Dr. Buchanan.

Lung disease.

which the operatives are placed? It does not appear, however, that old phthisis has been proving especially fatal of late, at any rate it has not been more so than would be accounted for by the cold weather of November Bronchitis and pneumonia,—the former especially,—have been, by the universal testimony of medical practitioners, of singular prevalence. Whether they were of signally greater amount than they would have been without the distress in a season so inclement as the present November* is a question not easy to answer positively. But it was maintained that this has been the case in all the towns visited, with the exception of Preston and Ashton, whose practitioners regarded the frequency of these disorders as only what they expected from the early onset of winter. Ashton, Blackburn, Bury, Chorley, towns where measles have been epidemic, have found this disease to have serious lung complications with quite unprecedented frequency. In like manner whooping-cough has been incessantly complicated with inflammation of the lungs, in the practice of the Children's Hospital at Manchester and at the Salford Dispensary. But here the great prevalence of such secondary lung disease could not be connected very certainly with the existing distress.

Rheumatism was said to be particularly common, among other places, in Ashton and Wigan.

Of diseases likely to result from breathing impure air in overcrowded and ill-ventilated rooms, some have been already referred to, and the epidemics will be immediately considered. Convulsions in children was asked about, and seemed to be of no especial prevalence. This is one of the maladies at ordinary times very common among infants in the manufacturing towns.

C. Connected with want of cleanliness.

C. As to the prevalence of diseases likely to result directly from want of cleanliness. An unparalleled quantity of itch has been observed in Blackburn, Manchester, Stockport, and Salford. In the same towns, and in Oldham, diseases of the eczema and impetigo class have also been particularly rife.

D. Epidemics.

D. Epidemic diseases, fostered as they are by bad diet, bad air, and want of cleanliness, constitute a further index to an exceptional prevalence of these agencies. Putting aside sporadic cases, the following complaints were met with in an epidemic form:—Chicken-pox in a part of Manchester; measles in Ashton, Blackburn, Bury, Chorley, Manchester, and, to a less extent, in Salford, Preston, and Wigan; whooping-cough in Chorley, Manchester, Salford, and Stockport; scarlatina in Ashton, Darwen, Manchester, Oldham, and, a month or two before, in Stockport; typhoid rather frequent in Bolton, Bury, Chorley, Darwen, and Stockport; true typhus cases seen in Preston, Manchester, and Chorley. Of chicken-pox, whooping-cough, and typhoid, no further mention need be made. Measles has been characterized in Ashton and Chorley by the singular amount of diarrhœa accompanying it, and here, as well as in Blackburn and Bury, by the universality of its lung complication. Ophthalmia, as frequently attendant on measles in Chorley, has been before mentioned. Scarlatina in each place of its occurrence has been distinguished by the extreme degree to which it has affected the mucous membranes. Very bad throats, with nasal discharges and glands in the neck greatly

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* London meteorology showed in some weeks of this November a mean temperature lower by six degrees of Fahrenheit than in the same weeks of ordinary years. This was when frosts were slight and intermitting in London, but when in North Lancashire the ground was covered with snow for more than a week together.

swollen, have been commonly observed, and in some places, as at Oldham, has given a highly fatal character to the epidemic. In this town, of 72,333 inhabitants, no fewer than 169 deaths from scarlatina were registered between midsummer and December 1st.

True typhus has already been considered sufficiently for the purposes of this report in the introductory part. Its existence gives perhaps the strongest evidence of a deteriorated physical state among the unemployed operatives. Here it is only needful to add that its death rate is that of a severe form of the epidemic, comparing it with the experience of London.

E. Connected with social changes.

E. Lastly, viewing the social and moral changes that might have resulted from the Lancashire distress, are there any exceptional morbid conditions that are likely to be related thereto ? On few subjects was more singleness of opinion shown than on the amount of disease and mortality among children. Medical men and registrars agreed that, apart from special epidemics, the ordinary maladies of childhood have been very lightly felt up to the present time. This fact was imputed with almost equal unanimity to the greater care bestowed on infants by their unemployed mothers than by the hired nursery keepers.* Though the mothers, from poverty or ignorance, still feed their children very injuriously, at least the little ones are safer against death by neglect or opium.

Under this heading comes another statement made with equal decision by medical observers. Drunkenness, with the diseases and accidents produced by it, is unequivocally less in the mass of the cotton towns. In Manchester, Salford, and Wigan only has this vice shown itself to its ordinary amount, and in these three towns there are probably the largest number of persons following other occupations than the cotton trade.

Venereal disease appears to be in excess of its average amount in Preston, and possibly in Stockport. It is believed to have decreased in Blackburn. All other statements about it are negative.

Summary of Part I.

To sum up the result of this inquiry, selecting only the most certain and widely spread conditions, it may be asserted :—

1st. That while actual death from starvation has been of the rarest occurrence, there is a peculiarly low state of health among the unemployed operatives of the cotton towns, showing itself particularly in the elder people, and predisposing to various diseases.

2nd. That scurvy and other evidences of a tendency to hæmorrhage have been seen with remarkable frequency.

3rd. That lung diseases of a sort to be induced and aggravated by exposure have been rife, even out of proportion to the cold of the season.

4th. That epidemic measles and scarlatina have habitually exhibited peculiarities that in ordinary times are only met with in weakly con-

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* When the urgency of the present crisis has passed away, the power of the Lancashire manufacturers in solving difficult social problems cannot be directed to a better end than in organizing means for preventing the scandalous loss of life that prevails among the infants of their female operatives. Among other suggestions to such an end this fact may be stated: At well-arranged infant nurseries in London, children can be maintained through the whole of a working day, and returned in health to their mothers on payment of 2*d.* for an infant and 4*d.* for a child requiring meat. In the cotton towns, children consigned to the care of any ignorant beldam cost 3*s.* a week; how they are fed and how they are drugged, their high mortality will show.

stitutions. That true typhus fever has shown itself. That epidemic diarrhœa has been below the average, except in Preston, which is the town that has suffered most from typhus fever.

5th. That disease from drunkenness and from neglect of children has been less common than in ordinary times.

PART II.

II. Concerning existing distress.

The other division of the inquiry consisted in ascertaining the existing state and habits, income and expenditure of the poor. Facts bearing on this subject were gathered in detail, and are reported separately for each of the twelve towns visited. Here, although no two towns are alike in all respects, a general statement may be attempted. In order to connect this statement with the facts given in the first part of the report, the arrangement of the subject will be similar to that therein employed.

A. Amount of income.

A. The amount of average income of the poor and the portion of it that is available for food; the sort of food obtainable, or habitually obtained by the poor, and its mode of preparation as affecting nutritive value. The pressure of the distress is much greater and has been felt much longer in some towns than others. Preston, Ashton, Blackburn, and Stockport, for instance, have been more severely and earlier affected than Oldham, Bolton, or Bury. Some towns again are exclusively dependent on the cotton trade. Others have machine making, bleaching and dyeing works which follow the stagnation in the cotton trade. A third set have other and independent industries, as the coal trade in Wigan, Chorley, and Bolton, the iron foundries of Manchester, Bolton, and Bury, the silk and flax mills in Manchester and Salford, and the woollen trade in Bury. All of these other industries have continued to furnish employment to a very large proportion of their usual hands. It is plain that when certain members of a community or of a family have these resources, the depression of the whole body is less than when it entirely consists of cotton operatives. This is one of the considerations that present obstacles to any precise summary statement of the income of the unemployed.

Nor in any one town is there a rule of strict application to all classes of the destitute alike. The personal character and former position of the distressed; their presumed ability still to earn a trifle by their own labour, although unemployed in the mill; the fixedness of the family in the eyes of the poor law; these are samples of the points that are thought of in estimating the scale of assistance to be given to destitute cotton workers. Families of this class who are only temporarily requiring public aid are generally assisted more liberally than those of the class of habitual paupers.* There is often one scale for the poorest class of cotton workers who are wholly destitute, and a higher scale for the better sort of operatives, particularly for any who are getting scanty earnings as half-time workers. As a rule, the former class falls to the charge of the guardians, the latter is mainly supported by the relief committees. The same persons receive relief from both sources

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* To deal liberally with the cotton workers, while the allowance to common paupers and labourers out of employ is kept at its usual standard, is the principle adopted in some towns. The rule appears sound, but one of its effects is, that the habitual paupers who, as beggars and parasites, usually add to their parochial allowance, and cannot now eke out their living thus, are feeling the uttermost privation. Many of this class are Irish, who, in addition to their privation, have the further predisposition to disease that comes of huddling together in dirty cellars and hovels.

in some towns; in other towns they are excluded from relief by the one, if they are in receipt of it from the other source.

Taking the great mass of the cotton workers with their families as a whole, their average income (in the present December) from all sources is nearly 2*s.* per head per week. This is exclusive of clothing, bedding, and firing, which are now usually supplied in addition. There are few relief committees which do not bring up the family income to more than 2*s.* per head per week (earnings or parish help therein included), while in some few instances the total is made up to 2*s.* 6*d.* per head per week. On the other hand, there are few boards of guardians that are giving so much as to bring the total income to the average scale, certain of them expecting the charitable funds to supplement the parish allowance, while others have been satisfied that the total income from all sources should reach 1*s.* 6*d.* or 1*s.* 8*d.* per head per week. In many unions, two months ago, sums even under these scales were expected to suffice.

"Scale" of income.

In speaking of a scale of income per head per week, it is meant that a family of average number would get this amount per head, nor does the scale per head apply with exactness to any other family. Thus, a single person would be in receipt of more than the scale, the youngest children in a large family get less than the scale. Generally the distribution is made somewhat in the following manner:—For a single person the income is brought up to the full amount and two-thirds over; the second person of the same family is reckoned to want the full amount and one-third over; all children above 16, living with their parents, about the same amount as the last; and each of younger children about a half or two-thirds of the scale.* Thus in practice the subjoined families would get per week about the amounts annexed:—

On a Scale of	*s.* *d.* 1 4	*s.* *d.* 1 6	*s.* *d.* 1 8	*s.* *d.* 1 10	*s.* *d.* 2 0	*s.* *d.* 2 2	*s.* *d.* 2 4	*s.* *d.* 2 6
One person - -	2 2	2 6	2 9	3 0	3 4	3 9	4 0	4 2
Man and wife - -	4 0	4 6	5 0	5 6	6 0	6 6	7 0	7 6
Man, wife, and young child	4 8	5 3	5 10	6 5	7 0	7 7	8 2	8 9
Man, wife, and 2 children (or 1 grown up child).	5 4	6 0	6 8	7 4	8 0	8 8	9 4	10 0
Man, wife, and 3 children	6 0	6 9	7 6	8 3	9 0	9 9	10 6	11 3
,, ,, 4 ,,	6 8	7 6	8 4	9 2	10 0	10 10	11 8	12 6
,, ,, 5 ,,	7 4	8 3	9 2	10 1	11 0	11 11	12 10	13 9
,, ,, 6 ,,	8 0	9 0	10 0	11 0	12 0	13 0	14 0	15 0

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* The larger proportion of income secured to the first members of a family is intended partly for the larger quantity they eat; partly to supply them with necessaries other than food, to which a very small addition will serve for the children; rent and candles, for example. By this unequal distribution, however, it sometimes actually results that *sixpence* a week is the allowance for each of the younger children. Thus the Salford union relieves families wholly unemployed on an eighteen-penny scale, as follows:—

	s.	*d.*		*s.*	*d.*
1 person - -	2	6	5 persons - -	6	6
2 persons - -	4	0	6 ,, - -	7	0
3 ,, - -	5	0	7 ,, - -	7	6
4 ,, - -	6	0	8 ,, - -	8	0

That the children are not starved is due to the Salford Relief Committee. In other places the excess to the first members was not so great, and the younger ones got a larger allowance than is shown in the text; thus at Darwen, with a two shilling scale, the relief committee only gave 2*s.* 6*d.* to a single person unemployed.

Expenditure;

Expenditure.—As clothing and bedding are either retained from better times or are given by the charitable committees, and in extreme cases are done without or supplied by the guardians, they need not be considered under the head of expenditure. Nor at present does fuel constitute a usual item of expense, though up to November outlay on this score was an important deduction from the incomes of the poor. The amount of money that is above spoken of as income is really required to meet four several sorts of outlay; (*a* and *b*) for food and for the profits of retail shopkeepers; (*c*) for supplementary necessaries; (*d*) for rent.

in food and retail profits;

(*a* and *b*). The separate consideration of these two items is rendered necessary by the varying practice of the relieving bodies. The guardians in ordinary times give half their relief in kind, but latterly have often given the whole in money. The relief committees have sometimes given their whole assistance in kind, sometimes partly in kind, sometimes wholly in money. Relief in kind, again, is given in more than one way, either by distribution from a store where all articles are reckoned at their contract value, or by tickets on certain shopkeepers which represent so much money in procuring stated articles. Or, again, the tickets may procure from any shop any article of food that is not positively wasteful, and then this mode of relief closely resembles relief in money. The extremes are relief wholly in money, relief wholly in kind from a store at contract prices. Under the one or the other plan there is an important difference in the amount of food that is procurable with the same nominal value of income.

The degree of this difference may be illustrated by the prices of some of the articles of most ordinary consumption at two retail shops and at the stores of certain relieving bodies. The quantities here mentioned are such as a single person would be likely to purchase for a week's consumption:—

Articles purchased.	Retail prices.		Contract Prices.			
	A Shop at Manchester.*	A Shop at Preston.	Guardians, Stockport.	Relief Committees.		
				Bury.	Bolton.	Manchester.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Bread, 8 lbs. -	1 0	1 1	†0 9	1 0	1 0	0 11
Potatoes, 5 lbs.	0 3	0 3	‡0 3	‡0 3	0 2½	‡0 3
Oatmeal, 2 lbs.	0 4	0 3½	0 3¼	0 3	0 3	0 3
Tea, 1 oz. -	0 3	0 3	‡0 3	‡0 3	0 2	0 2
Sugar, ½ lb. -	0 2½	0 2½	‡0 2½	‡0 2½	‡0 2½	0 2¼
Bacon, ¼ lb. -	0 1¾	0 2	0 1	0 0¾	0 1	0 1¼
Total -	2 2¼	2 3	1 9¾	2 0¼	1 11	1 10½

* This was a general shop of the class frequented by the poor, kept by a very worthy and intelligent person. That at Preston was similar.

† In all instances "bread" means best white bread, except that at Stockport it was probably "seconds" bread that was given. Seconds bread retail cost 10½*d.* or 11*d.* for the 8 lbs. In the case of bread, sugar, &c., it might be part of the economy of the stores to wean the poor from their love of the whitest possible sort.

‡ Articles to which this mark is attached were not given from store. Retail prices are therefore attached. If the contract prices of other towns had been inserted instead, the totals of the last four columns would have been even less. In the purchase of soap and coal the disproportion between retail and contract value is, perhaps, even more considerable than in the case of food.

Hence it appears that a shilling given in money, and 10*d.* (or less than 10*d.*) given in kind are of equal value. Even this equality is only when the poor choose their food with the same regard to economy and get the same purity at the shops as at the stores. In practice they are too often disposed to spend money in the fashion of prosperous times, and too often are defrauded by adulteration. Again, from the want of farthings,* to say nothing of still smaller coins, there are constant small losses in the purchases of the poor that are avoided when the relief is given in kind.

in other ways;

(*c*) and (*d*). But before the income of the unemployed is available for food, it is reduced by outlay for other necessaries and for rent. Under the former head, fuel has now almost ceased to be an expense. Candles are still a charge of from 2*d.* to 4*d.* a week for a family; soap is given by several relief committees, others leaving it to be purchased.

in rent.

The question of rent will be presently considered in detail. Here the conclusion must be anticipated, that in practice a shilling a week is often expended by an average family in payment or part payment of their rent, and that this so often really is paid out of the present average income that it must be considered in estimating the amount that is available for food.

Taking therefore the very ordinary case of a man, wife, and two children whose income is made up to two shillings per head per week, their expenditure under the four heads would probably now (December) be as follows:—

	s.	*d.*	
Food (at contract value) -	5	8	an average; varying according as relief is given more in money or in kind.
Retail profits - -	0	10	
Candles and similar necessaries.	0	6	
Rent - - - -	1	0	(an amount often paid in practice)
	8	0	

Income available for food.

Here it is assumed that there is no outlay on clothing or bedding, and scarcely any on fuel or soap. Hence this family of cotton operatives in an average town, under average conditions of earning and relief is in the present December getting per head per week such an amount of food as can be provided at contract prices for seventeen pence.† Nor has the amount of their income prmitted of so high an expenditure for food until quite recently. From the commencement of the distress until November scarcely more than three-quarters of the amount of food represented by these sums was procurable.

Sort of food.

The nature of the diet of the operatives has of course a bearing on their nutrition scarcely inferior to the actual amount of their food. The preparation of their food is also of considerable moment.

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* The Master of the Mint has favoured me with a very interesting statement on this subject, and informs me that he has "made an effort to press the use of farthings "in Manchester, by sending down 60*l.* worth to an active distributor, who has "several large grocery shops. He did all he could to promote their issue, both in "his own and at other shops; but after a trial of several months he was obliged to "return a balance of 15*l.* unsold."

† There is constantly another small outgoing that has not, as far as I know, been noticed by the relief committees. Many cotton workers have their children in a burial club, and are religiously paying, from their poverty, the ordinary weekly penny per head. This, of course, comes out of the balance available for food.

APPENDIX.

V. The Cotton Famine.

1. Health of operatives. By Dr. Buchanan.

Lancashire operatives have been used to live on a very generous diet, and doubtless experience more ill effects from a lack of animal food than if they had not been accustomed to its liberal use. They do not see in prosperous times the advantages of a careful domestic economy, and now in hard times they have no knowledge how to make the most of their scanty incomes. If their money spent in food were laid out to the best account,* and if they were able to cook the food in the most useful manner, without waste, their incomes would go a long way farther in preserving them in health.

Now-a-days the ordinary diet of the unemployed is exclusively vegetable, or they occasionally afford a bit of bacon, cheese, or butter, a herring, or rarely a morsel of cheap meat. Bread constitutes the greatest part of their daily food. Oatmeal (or meal of Indian corn less commonly) is the next most usual food, made into porridge or into various sorts of bread. To these a little butter or treacle is added, generally for the children, when they can afford it. Potatoes stand next, being happily good, cheap, and generally popular. Partly from want of utensils, partly from inexpertness, their cooking gives no variety to these materials. Tea with sugar, but usually without milk, is now the common drink. In very few families can a proper amount of milk, even if any at all, be bought for the children; they are put on the same food as the adults at much too early an age. Animal food is now very scantily consumed, the poorest usually buying none; but in almost all towns there are soup kitchens, where a quart of good meat soup is given for a penny, though its materials alone generally cost five farthings or more.† In some few towns, potato-hash (locally called lob-scouce) may be had at a penny per pint. Again, in Manchester and Salford, public dining kitchens have been lately established, where not only soup, but meals of meat and potatoes, &c. can be had for an extremely small payment. In these ways a dinner containing about two ounces of animal food can be got for the same money that in the homes of the poor would only procure a dish of potatoes or a basin of porridge.

The articles supplied as relief in kind from the stores of guardians and relief committees vary a good deal. Bread and meal is all that is given in some towns; in others, bacon and cheese are added, or tea and sugar; potatoes are distributed in a few instances. When relief in kind is given by tickets on stated shopkeepers, the same articles are procurable, and the donors often stipulate for the kind, quality, and price of them. When tickets are presentable at any shop, the poor have to use their own discretion on these points. It is constantly asserted that they are best pleased to get their assistance in money or by tickets whose currency is the least limited. If this be so, they prefer a plan which certainly gives them no advantage, but the exercise of their own ill-disciplined choice.

Income and expenditure in various towns.

Hitherto, the amount of income of the operatives, and its availability for food or other necessaries, has been considered as an average of the

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* An extreme instance of their ignorance in this respect is the case of a poor girl at Preston, who paid half her earnings in rent, and tried to keep herself alive on the remaining fifteen-pence a week. This might have been difficult with the best of management; but her notions of economy were comprised in bread and tea, and death by scurvy was the result of them.

† The following is the receipt for soup at Bury:—Beef, 55 lbs.; peas, 49 lbs.; barley, 39 lbs.; carrots, 12 lbs.; onions, 8 lbs.; salt, 6 lbs.; pepper, 6 oz.; water, 26 gallons. Boiled by steam for 12 hours, bringing the whole quantity up to 80 gallons. In a quart of soup there are nearly $1\frac{3}{4}$ oz. of meat. The loss of a farthing on every quart of 800 gallons daily of this soup, as well as the management expenses, are defrayed by the servants of the local railway as their contribution to the relief of the distress.

cotton districts in general. It remains to state the same facts for each of the towns visited. The difficulties in doing this with accuracy are very great, from the extremely varying plans of relief in the several towns. But in the following tabular statement an approximation to exactness has been got by a careful examination of every known detail. Here are exhibited for each town the smallest and the largest ordinary income of a family of cotton workers consisting of a man, wife, and two children. The figures cannot be everywhere applied to labourers and others who are out of work, but whose distress has not come directly of the cotton failure. Such persons being in receipt of relief almost every winter are generally relieved to a total amount below the lower of these two scales.*

Total weekly Income of an average Family of a Cotton Worker—man, wife, and 2 children—in the under-mentioned Towns.—December.	Lowest prevailing Scale of Weekly Income for the poorer Class of Cotton Workers and those wholly unemployed (habitual Paupers generally getting less than this).					Highest prevailing Scale of Weekly Income for the better Class of Cotton Workers, and those at Part Work. Earnings usually supplemented to this Scale.				
	Total Income, to which Clothing, Bedding, and Firing generally added.	Would probably be spent as under.				Total Income, to which Clothing, Bedding, and Firing generally added.	Would probably be spent as under.			
		Food at Contract Prices.	Profits to Retail Dealer.†	Other Necessaries,‡ sometimes *f* including Fuel.	Rent§ or Instalment thereof.		Food at Contract Prices.	Profits to Retail Dealer.†	Other Necessaries,‡ sometimes *f* including Fuel.	Rent§ or Instalment thereof.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Ashton - -	8 6 (7*s.* in Nov.)	6 3	1 2	0 3	0 10	9 0	6 5	1 3	0 4	1 0
Blackburn -	7 0 (5*s.* 6*d.* in Oct.)	5 2	0 9	0 3	0 10	8 0	5 8	1 0	0 4	1 0
Bolton - -	6 0	4 7	0 8	0 3	0 6	7 6	6 3	0 3	0 2	0 10
Bury - -	7 0	5 0	0 11	0 3	0 10	8 6	6 10	0 4	0 4	1 0
Chorley - -	8 0	5 5	1 1	*f*0 8	0 10	8 0	6 3	0 6	0 3	1 0
Darwen - -	8 0	5 10	1 1	0 3	0 10	8 6	6 1	1 2	0 3	1 0
Manchester, City.	8 0	5 11	0 5	*f*0 8	1 0	8 9	6 11	0 4	0 3	1 3
Oldham‖ - -	8 0 (in Nov. 7*s.*)	5 5	1 1	*f*0 8	0 10	10 6	7 4	1 4	*f*0 10	1 0
Preston - -	8 6 (7*s.* in Oct.)	5 6	1 1	*f*0 8	1 0	10 6	7 11	0 10	0 4	1 3
Salford - -	8 0	5 11	0 10	0 3	1 0	10 0	7 5	1 0	0 4	1 3
Stockport -	7 4	5 9	0 6	0 3	0 10	8 6	6 6	0 8	0 4	1 0
Wigan - -	7 0	4 8	0 10	*f*0 8	0 10	8 8	6 9	0 9	0 4	1 0

† Under this item is seen the largest amount when the income consists wholly of money; the least amount when assistance is mostly in kind and on a store supplied by contract.

‡ Under the head of these necessaries is put down rather the minimum amount that it is possible to do with, than the average amount really spent on small matters in the house.

§ In this column such a sum is placed to the account of rent as would in many cases be paid, as an instalment, by a family in receipt of the total amount indicated. Perhaps a larger number of families would pay nothing at all, while some would be paying their full rent.

‖ The *allowance* for rent in Oldham, to the family in question, would be 2*s*. But as there is no reason to believe that Oldham differs materially from other towns in the amount of rent *actually paid*, it is here assumed for this town as for others that the landlord would be put off with an instalment of his rent. Only in this way is it possible to place Oldham with fairness in the list.

That income formerly was less, and distress is unequal, to be remembered in comparing the several towns.

The standard of income in each town has not been the same from the beginning of the distress. Almost everywhere it has been lower than its present amount. Moreover in the earlier months of the autumn, destitution was prevailing to any considerable extent in some

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* See note* to page 305.

Appendix.

V. The Cotton Famine.

1. Health of operatives. By Dr. Buchanan.

of the towns only, while others were maintaining very nearly their old prosperity. These two considerations must be allowed to have weight in any comparison between the towns. They explain, partly, if not entirely, the discrepancies which at first sight appear between the total amount available for food in the different towns and the prevalence of a low state of vitality therein. Thus, though on the table the minimum income at healthy Bolton appears so small, it is to be remembered that up to quite recent times operatives at Bolton have been earning comparatively plentiful wages, and on the other hand, when the incomes at Preston, Ashton, and Stockport (towns of lower present health) are shown so high, it is to be noted that in these places many of the mills have been closed since the earliest spring; that the organization for the relief of the poor, being in them first wanted, did not at once attain its full efficiency; that scales of income lower than the present were regarded as sufficient until the low health of the operatives forced itself to notice; and lastly, that at the outset, the cotton workers deprived themselves of the veriest necessaries of life under a sentiment of independence that in towns more recently suffering has given place to wiser counsels. In brief, the duration of the distress has had as much to do with the present low vital state of the people as the actual degree of privation.

Requisite minimum for food.

All the facts that have been ascertained point to the conclusion that low health and actual disease have resulted, and will result, from the income of the unemployed being below the standard that would procure them adequate food.* It may be positively asserted as the result of actual observation that health cannot be supported on an amount of food less than is represented by 1*s.* 6*d.* per head per week, wholesale value, or 1*s.* 9½*d.* retail value. And there is evidence to make it further highly probable that even on this scale a deterioration of health will gradually ensue. The highest of all the prevailing scales of income, namely those secured to the most favoured operatives in Oldham, Preston, and Salford is only what is quite necessary to ward off ultimate loss of health and strength. In these towns about 1*s.* 10*d.* per head per week is the sum practically available for food at contract prices, or 2*s.* 2*d.* retail prices.

B. Lodgement and clothing.

B. *The existing condition of the unemployed operatives as to lodgement and clothing.—Houses and House-rent.*—The better class of cotton workers are inhabiting the same self-contained cottages of three or four rooms that they have occupied in prosperous times. There is little disposition among them to crowd together, though often a married son or daughter comes back to the old home to save rent. Among the poorer sort of operatives many who formerly rented a two or three roomed cottage content themselves with a single room, while others take in a stranger to lodge in their families. In the poorest class two families frequently occupy a single room, one bed sufficing for the whole of each family. The actual paupers, and especially the Irish, are even worse lodged than this.

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* The statements as to the minimum incomes of the poor have not in the above been influenced by a consideration of special instances where the income has fallen seriously below the average, such instances usually resting on the unconfirmed statements of the persons themselves. But in notes to the more detailed accounts of the several towns are mentioned cases of much severer privation than was contemplated by the local administrators of relief; and this even among cotton workers. Sometimes this has been brought about by delay of the people themselves in making their representations; sometimes by their being paupers and removeable; sometimes by much rent having been exacted out of little income.

APPENDIX.

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Rent.

The amount that is being paid for rent varies a good deal in different towns, and in the same town according to the means and disposition of the landlord. The owner of a single cottage is often a poor person, to whose support its rent is a material contribution. Larger owners of cottage property can usually better afford to wait for their rents, and as a rule they are bearing with great liberality serious losses on this score. Distraint is very rare, and not many cottages are to be seen empty. And although there are some instances of half-time wages being stopped in payment of rent to the extent of more than half the total earnings of a family, such cases are happily very few. On the average, probably, much less than half the usual amount of rent is being paid. But the average is of less importance for consideration than the actual sums that are in a large number of instances being demanded. The actual cost in rent to a single girl living with a family, sharing their bedroom and benefiting by their fire and lights, is from 9*d.* to 1*s.* 3*d.* a week. For a single unfurnished room in a cottage 1*s.* to 1*s.* 6*d.* would be paid. The rent of various cottages is from 1*s.* 6*d.* to 4*s.* 6*d.*, and of this one half or one third is frequently paid. For an average family the amount that is very often disbursed in rent is 1*s.* a week, either in payment for a single room, or as an instalment of the rent of their cottage.

Want of provision for rent.

Only in one town do the guardians or the relief committees make a separate provision for the rent of the people whom they are assisting. The Relief Committee of Oldham constitutes that single exception. But speaking generally, the relief committees usually regard a portion of their grant as applicable to the payment of rent, or of such instalment of rent as may satisfy cottage owners for the present. It is with this object, among others, that their scale of relief gives so much more to the first members of a family than to the children. On the other hand, the guardians usually fix the income of those relieved by them on the assumption that rent is not paid. The authorities of some unions indeed point to instructions of the Poor Law Board as forbidding them to consider the question of rent in any shape.

In the considerable number of cases where some rent is being demanded of people wholly or partially unemployed two results have followed. Either an encroachment is made on the already scanty sum that should be available for food,* or money is saved by sharing a house or room between two families.

Overcrowding.

Overcrowding of houses is distinctly on the increase among the operative class in the cotton towns. Already this may be seen to a degree fatal to cleanliness and purity of air, and equally fatal to sexual delicacy. There is even a large and increasing number of cottages that are coming into the category of common lodging houses, and in them evils are springing up of the sort that existed in such houses before their regulation by Act of Parliament. No new number of cottages, however, is being registered as common lodging houses, and the advantages of registration, in securing cleanliness and ventilation, in separating the sexes, and in preventing overcrowding, are therefore not obtained. The registered common lodging houses are, as a rule, very thinly tenanted, their ordinary charge of threepence per night being now beyond the means of their usual occupants.

Bedding.

There has been in the poorest cottages a further reason for overcrowding, besides the desire to save rent. In the bitter frosts of November the most destitute began to huddle together as closely as possible for warmth, and being sadly deficient in bedding, their day

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* See note *, page 309.

clothes often serving for their only covering by night, they carefully excluded from their crowded bedrooms every breath of air. If they rented two bedrooms they brought the beds together into one. Six or eight people would come at night into a room 12 feet square, with the window and door closed and padded, and the fire-place (as is almost universal with them) thoroughly papered up, and lie as closely as they could, for the heat of each other's bodies. They got their warmth indeed, but in a fashion that was monstrously hurtful to their health. It may be hoped, however, that a check has now been given to overcrowding, so far as it results from mere cold, by the liberal supply of bedding that has begun to be distributed in all the towns visited.

Sewing schools;

Sewing schools.—From a medical point of view it would hardly be possible to give too much praise to the schools that have been extemporized for the employment of cotton workers who have lost their usual occupation. Thousands of persons, but especially of young women, are provided in them with shelter and warmth throughout the day, are set to useful work, furnished with clothes and money, and kept from the mental harm of idleness. To suggest a fault in such institutions is an unwelcome duty, but there is one that in most of them challenges attention from the medical visitor. An exceeding deficiency in ventilation pervades them. These schools are generally held in the large low rooms of an empty factory or in a schoolroom intended for a less number of children. Often the original construction of neither place has provided for any sufficient change of air, ventilation without draught being scarcely possible. The girls, used to their hot mills, insist on shutting all the windows, so that the atmosphere of the sewing schools is often intolerably close. The lady superintendents often leave off work with intense headaches. The girls' faces are seen unhealthily flushed, and it is no uncommon thing for one of them to faint over her sewing. In the event of any infectious disease hanging about the person or clothes of any girl, it is easy to see that the danger of this bad ventilation would be especially great.

ventilation of.

Clothing.

Clothing.—The clothing of the operatives has been gradually disappearing since the beginning of the distress. First their Sunday dresses, then their changes of linen, have been sold or pawned, and their single suit of clothes, if not also diminished in the same way, has been worn to shreds. The poorest people were constantly without any under clothing, and a single petticoat and boddice often formed the entire wardrobe of a woman or child. In this state they were found by the early frosts of November. Their bedding was at the same time deficient. The intense prevalence of bronchitis was the consequence. Actual exposure to wet and cold, if it had been superadded, to this want of clothing, might have been expected to have caused even more lung diseases and a higher mortality from them than have here been recorded. But, in fact, such exposure has been less than usual in the present winter ; there has been small necessity for women and children to leave their homes. The male cotton workers, however, who have been employed at out-door labour do appear to have suffered with especial severity from diseases produced by cold, owing to their bodies being so inadequately protected against it. Out-door labour, when employed as a test by the guardians, has sometimes been excused in the worst weather.

Since the beginning of November the relief committees of all the towns, and the guardians in some instances, have been liberally

C. Cleanliness.

supplying the deficiency of clothing and bedding. We may trust that another frost will find the cotton workers better prepared by clothing to bear its rigour, even if they should be still further reduced by privation.

C. *The present state of the unemployed people and their houses in respect of cleanliness.*—As affected by the prevailing distress there is nothing to be said about the exteriors of streets and houses as to paving, scavenging, and emptying of middens. Some towns, however, are in a much better state than others in these respects, Preston (though vastly improved of late years), Blackburn, and Bolton standing somewhat badly. But in the insides of houses inhabited by the poorer classes, there is a general want of cleanliness that appears to be in part connected with their having more inhabitants, and in part due to the cost of cleansing materials. Landlords, whose weekly visits for rent are paid in vain, appear to have become careless about the wholesomeness of their houses, and few of the local authorities have acted on their powers in compelling the removal of unwholesome conditions from the interiors of cottages. Systematic sanitary inspection has not extended beyond common lodging-houses.

Domestic cleanliness has been often preserved under many incentives to its neglect; the gratuitous distribution of soap by many of the committees has doubtless tended to this result. In their persons, if the old standard of tidiness has not been possible, there has been at least less slovenliness and dirt than might have been anticipated. Among the poorest it has of course been hard to keep clothing and bedding clean when there has been no change of them, and the increased prevalence of itch in some towns cannot but be connected herewith. The guardians of the Preston union, when a dirty person comes for relief, send him off with a ticket to the nearest bath before considering his case.

Summary of Part II.

The conclusions that have been arrived at in the second part of this report, as connected with the points observed in the first part as to the general vital state of the unemployed people may be thus recapitulated:—

1st. The amount of income of a family wholly or partially out of work varies in different towns, and has been less in almost all of them, than it is at present. It is now, in December, nearly 2*s.* per head per week in the cotton towns as a whole. Out of this amount 4½*d.* must be spent on rent and domestic necessaries. The remaining 1*s.* 7½*d.* is all that can be available for food. Of this sum 2½*d.* goes in profit to the retail dealer, while 1*s.* 5*d.* is the outlay for each person's weekly food at contract prices. Such an amount of food is not adequate to preserve health and strength through a lengthened period.

2nd. In three towns the most favoured operatives are now relieved on a scale which allows of their procuring food to the value of 1*s.* 10½*d.* (contract price) per head per week. This is equivalent to 2*s.* 2½*d.* or more, expended in procuring the same food at a retail shop. It is desirable that a scale so high as this should not be the exception, but the rule. No lower minimum standard can be considered adequate to maintain health and strength. Strong confirmation of this view may be got from examining the dietary of an average in-door pauper of a workhouse. In the Salford union, for instance (which relieves its out-door poor with 1*s.* 6*d.* per head per week), every man, woman, and child in the workhouse costs 2*s.* 1*d.* weekly for food alone at contract prices. Making 2½*d.* deduction from this for extra dietaries of the sick, the remainder would be the exact sum here regarded as the minimum for health in the distressed operatives.*

1. Health of operatives. By Dr. Buchanan.

3rd. Relief given as food is preferable to relief given as money or by tickets on unspecified shops,† as saving loss in change and by adulteration, preventing waste by the poor, and enabling the donors to apply to the selection of food the best medical advice attainable. Cooked food, as part of relief in kind, offers some peculiar advantages.

4th. Clothing, bedding, and firing have been seriously deficient, and their want has contributed to disease. They are now being pretty universally supplied to the poor, in addition to the foregoing scale of income.

5th. Rent is often being paid out of amounts that ought to be available for food. It is desirable that this should be prevented, and that means should be contrived for otherwise satisfying or postponing the claims that are made for rent on the unemployed. A further reason for anxious attention to the question of rent is, that overcrowding is seriously prevalent, and will be the fruitful source of disease and immorality if it should increase. To reconcile the urgent claims of the poorer cottage owners with the conditions imposed by the poverty of their tenants is a problem difficult of practical solution; but it is not one that will baffle the powers of Lancashire gentlemen if it be taken into full and direct consideration.

6th. The interiors of cottages are frequently dirty and the rooms overcrowded. There has been no efficient inspection as to these points under the Nuisances Removal Act. Numbers of tenements are becoming common lodging-houses without being registered.

7th. The sewing schools and kindred institutions are of great value to the health of the unemployed population. Their ventilation, however, is in serious want of improvement.

8th. Personal cleanliness would be enhanced by providing for each person two suits of such clothes as can be washed. Tickets on a bath, given in Preston, offer an example worthy of imitation.

2.—DR. BUCHANAN'S SUPPLEMENTARY REPORT (March 14, 1863) on the HEALTH of the GIRLS in the SEWING SCHOOLS at PRESTON.

2. Health of girls in Preston sewing schools. By Dr. Buchanan.

IN the sewing schools established by the Preston Board of Guardians to give occupation to the unemployed factory girls, it has lately seemed that the scholars have been getting out of health, especially by contrast with other girls recently come to the school. At the request of the managers of these schools, an investigation was ordered into the nature, extent, and causes of impaired health in the school-girls, and the following is the result.

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* "Necessaries" (soap, candles, firing,) in this workhouse cost 3¼*d.* per head per week, or something more than (including coals) has been reckoned to their account in the text.

† Retail shopkeepers are of course injured, *pro tanto*, as the relief of a town is given in kind. They are in the habit of complaining at this, and of saying that they, too, must come on the charitable funds if their usual customers are supplied from the committee's stores. This appears true, and much to be regretted; but it may fairly be remembered that even when relief is given wholly in money, these shopkeepers are not very indirectly partakers in the charitable aid, inasmuch as the incomes of the operatives have to be made up to a larger amount in order to admit of retail profits. Too much weight must not, therefore be attached to this complaint, if it be true that there is a positive economy and advantage to the community by the plan of relief in kind.

APPENDIX.

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Method of inquiry.

In the two chief sewing schools of the Guardians of Preston (those at Mill Hill and Knowsley Street) inquiry was made in detail as to the condition and circumstances of 35 girls who were selected by the managers as being sufficiently representative of the whole.* The sewing schools established with the same object by the Preston Relief Committee were also visited, but without detailed examination of the scholars. The facts that were thus ascertained appear to establish a connexion between the health of the girls and the amount and character of their food; and again, between their health and the atmospheric conditions under which they are placed in the schoolrooms.

Representative girls, their health.

Of the 35 girls† examined in the Guardians' sewing schools, eight (A) had ailments that had either existed before the cessation of their factory work, or appeared independent of their altered circumstances. Four others (B) had also experienced some loss of health, but not during their attendance at the school, one or two of them having even improved since coming to the sewing classes. There remained 23 girls, in whose cases disturbing influences were so far absent that their state of health could be usefully connected with their present circumstances. Of these 23, five (C) said they were in actually better health than when they were at mill work; twelve (D) stated that they were as well as, certainly not worse than, when they were so employed; while in the six others (E) more or less deterioration of health had occurred.

Character of new ailments.

In the six girls comprehended in the last class (E), the most constant symptom of new origin was a loss of colour noticed by their friends and themselves. Two girls said they had distinctly lost strength and flesh. Unaccustomed fainting and palpitation were complained of by three, and three of them suffered from headache (evidently anæmic) and giddiness. The girls (B) who had got out of health between leaving the factory and coming to school had mostly lost flesh in that time, but did not show other symptoms with any constancy.‡

Income of the girls.

The 35 girls were all in receipt of 2*s.* a week from the Guardians, and of two sixpenny tickets from the Relief Committee. One of these tickets represented 4¼ lbs. of bread, while the other procured either tea and groceries or more bread. Several girls were from time to time in receipt of a few additional pence, but the assured income of all was 3*s.* a week apiece.

Fourteen of the girls were living in lodgings and supporting themselves, and themselves only, on their weekly income.§ The other 21 girls were living with their families, and put their 3*s.* into the general stock. Their own share of the family income thus came to depend on the prosperity of the rest, and was found to vary between 4*s.* 3*d.* and 2*s.* 3*d.* weekly, averaging 2*s.* 9*d.* each, taking the 21 girls together.—The girls or their families universally spent a portion of their income on other objects than food; the most constant of such sources of expense was rent. With girls living in lodgings the payment for rent was generally 1*s.*, but varied from 1*s.* 3*d.* to 6*d.*; this payment always including coals and generally candles. Washing ma-

Expenditure on rent, &c.

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* The selection erred, if at all, on the side of representing the health of the school in too unfavourable an aspect.

† Though the scholars are mentioned as "girls" throughout this report, their age was generally about 21, and ranged between 15 and 35 years.

‡ Swollen gums were observed in a good many girls, but these might be ascribed to the state of the teeth, and in none did the gums very readily bleed. Such gums were seen alike among the girls who got and those who did not get plenty of potatoes.

§ It may be mentioned that among these girls living in lodgings, many of whom were orphans, were found double as many of the invalids (Class A) as among the girls who lived with their friends.

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terials and other small matters cost another few pence.—The amount available for the week's food thus became, in the average of the 14 girls living in lodgings, 1*s.* 11½*d.* each, the extremes being 2*s.* 6*d.* and 1*s.* 3*d.*[*] As for the girls who lived with their families, after rent had been paid, firing, candles, and washing provided, and other small expenses defrayed, the share of the family income that fell to the sewing girl, and was exclusively available for her food, was found to be 1*s.* 7¼*d.*; the extremes here being very wide, 3*s.* 1*d.* the highest and 1*s.* 1*d.* the lowest.

Available for food.

Connexion between health and amount expended on food.

A consideration of the income of the girls in connexion with their health will be advantageously made only as regards that portion of income available for food, and in the cases of the 23 girls comprised in the above groups, C, D, and E. It was found that those girls (C) who said they were better than formerly, had very various allowances for food, so various that the impression arises that their improvement must have resulted from other influences than merely dietetic, probably from avoiding in their present occupation the more unwholesome parts of mill work.[†] Among the 12 girls (D) whose health was maintained at its usual standard were found the highest incomes available for food, averaging 2*s.* 1¼*d.* per week for each girl. With one the food income was 3*s.* 1*d.*, and with three only did it fall below 1*s.* 10*d.* per week. But in the cases of the six girls (E), whose health appeared impaired during their attendance in school, an investigation of their income and expenditure showed that 1*s.* 6*d.* was the highest sum in any case available for the week's food, and that with three girls this sum actually fell as low as 1*s.* 1*d.*

Sort of food procured.

The girls were further questioned as to the character of the food they procured. Of the five girls who stated that their health was improved, three habitually got fresh meat on Sundays, and the others either bacon or herring.—Next, of the 12 girls whose health was satisfactorily maintained, eight got fresh meat once a week, and a ninth got it occasionally, these girls sometimes getting other animal food as well. But there were three of the 12 who having formerly been used to meat said they had had no solid animal food for some months, and yet they also had kept in good health.—Lastly, among the six girls (E) who were really failing in their health, not one got any fresh meat even on Sundays, while a bit of bacon was rarely got by some, and never by others.—Of the 23 girls, then, 11 got fresh meat on Sundays, and 12 did not. All the 11 kept in health or had improved; six of the 12 who got no fresh meat also kept in health or had improved; but the remaining six were losing health and strength. When it is remembered that in good times the factory girls are accustomed to the liberal use of meat, it is not surprising that many of them should feel ill effects from the deprivation of it.

No distinction of value could be drawn between the girls who habitually got fresh vegetables and those who rarely got them. Nor, beyond what has been said, did there appear any single article of diet whose use or absence could be connected with the health of the girls.

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[*] Only one girl living by herself had an income for food lower than 1*s.* 6*d.* This was a girl about whose statements there might be some uncertainty. Attention, however, had been attracted to her health, through her having fainted several times while in school.

[†] It is to be regretted that the special department of factory work at which each girl had earned her living was not inquired into. In the absence of information on this point, it must, in strictness, be assumed that all the girls would be influenced alike by their change of occupation.

Summary of connexion between health of girls and their food.

As for the relation, then, between the health of the sewing classes and the food of the scholars, the following may be asserted :—1st. Health is being maintained on so much food as can be bought with *2s.* 1¼*d.* a week. Loss of health is ensuing very generally, where from any cause the portion of income available for food falls materially below this point. 2nd. Although the character of the food procured is of less moment than sufficiency in its quantity, still it is shown to be probable that deprivation of fresh meat is assisting in the observed loss of health.

Atmospheric conditions.

The examination of the conditions of atmosphere under which the girls were placed, had reference only to the period of their employment in school. The average attendance of girls in the sewing schools of Mill Hill and Knowsley Street is such that in those buildings each scholar has at least 120 cubic feet of air. There are here windows and ventilators that will admit sufficient air without much draught, and ample means of warming are provided. With an ordinary attendance, therefore, and if use is made of the means of ventilation, the air of these schoolrooms can be maintained sufficiently pure and warm. But when an unusual attendance of scholars reduces the breathing space for each to only 70 to 80 cubic feet, or when, as often happens, the girls' love for hot rooms makes them shut out every breath of fresh air, the atmosphere of these rooms becomes very oppressive. Several sewing schools supported by the Relief Committee, are held in the rooms of empty factories, in which the ceiling is very low in proportion to the area of the room. In these schools the cubic space available for each girl may be found as low as 60 cubic feet, and this even when the attendance does not exceed the average. This, of course, constitutes a reason for making the communications with the outer air as free as possible ; but in practice, as these low rooms can scarcely be ventilated without draughts, there is the greatest objection made by the girls in them to the admission of the external air. Hence the atmosphere of these schools is to a visitor often intolerably hot and close. The lady-superintendents of the sewing classes, who are not like the girls accustomed to the hot air of the factories, have been very subject to headaches and catarrhs, and they have noticed that on a reduction being made in the number of scholars, these ailments have been less experienced than before. The girls themselves, in their terror of fresh air, never complain of the closeness of the schoolrooms ; but in several cases the superintendents have had occasion to refer attacks of fainting among them to this cause. In one of the large low schoolrooms just mentioned, it was observed that the heat of the sun through the shut windows of one side of the room had made that side much hotter than the opposite shady side, where the windows were open. On the heated side the girls appeared to the visitor pale and languid, and some were found, on examination, perspiring and faint ; while on the cool side of the room they looked distinctly brighter, and had more colour in their faces.*

Duration of attendance.

The duration of attendance at the sewing schools did not appear to have had serious influence apart from other considerations in determining good or ill health in the girls. Thus the six who had fallen

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* But though the school in question was extremely oppressive to the visitor, and indeed, afforded the smallest cubic space to each scholar anywhere observed, no positive deterioration of health could be ascribed to the impure air. The girls, as a body, affirmed that they were as well as when they were at mill work. And seeing that the atmosphere of a factory is itself often unhealthily hot and close, while some portions of factory labour are acknowledgedly injurious, it is not to be wondered at that the usual standard of health in the mills should be maintained in the schools, even if the schoolrooms should be unwisely close and crowded.

out of health during their attendance had been on an average $5\frac{1}{2}$ months in school, and the five girls who had improved had attended for an average of 5 months. The girls who had recently joined the sewing classes, immediately upon the stoppage of the mill where they had been employed, did indeed, in some instances, look rosy and well above the ordinary standard. But on the other hand, girls who had joined the school some time after their mill closing, were certainly below the standard of health of the school at large.

No comparison is required between the girls in attendance at the Guardians' schools and those at the schools of the Relief Committee. There is probably no material difference between them. It happens that of the two bodies, the Guardians were the first in their kindly anxiety to anticipate a decline in the health of their girls.

Conclusions and suggestions.

In conclusion then, it appears that the total weekly income of a girl in the Guardians' sewing schools very closely meets her actual necessities of rent, firing, washing, and food, when that income is expended exactly for these objects and for her own benefit only. But this income becomes at once insufficient for the supply of food if it is made to contribute to the support of others, or if it is used to supply other wants, such as clothing. It follows that it would be extremely desirable to make inquiry concerning expenditure and the family income wherever any circumstance suggests that a girl is insufficiently provided, but that no corresponding good could be expected from a large and universal increase on the total income of the girls. It may be mentioned that one of the most constant and laudable of the small outgoings is 2*d.* a week for washing materials. The gift of such materials, in addition to other relief, would enable each girl to spend so much more for food, an amount of real consequence when the income available for food is so closely on the edge of what is adequate.

Secondly. It would be very desirable, and could probably be easily contrived, that the sewing girls should get their dinner at the schools twice a week. Thus a meal, such as potato-hash, containing fresh vegetables and about two ounces of meat, might be provided at the same cost to the girls themselves as now provides them in their own homes only the innutritious and monotonous dinner of bread and tea. Perhaps it could even be contrived that the families of the sewing girls should share in this advantage.

Thirdly. It is much to be wished that 120 cubic feet,* at least, should be secured to each girl in the sewing school; when necessary by a limitation of the number of scholars in a room. In all cases due continuous ventilation of the rooms should be resolutely insisted on. And with such ventilation the temperature that would be the best to adopt for a mean, is probably 65° Fahrenheit.

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* The minimum allowance for each child in a National school, where the strictest care is taken in the construction of the building to get proper movement of air, is 80 cubic feet. Grown girls, lodged in a room difficult to ventilate, should certainly have at least half as much again of cubic space; as much more, of course, as possible.

APPENDIX.

V. The Cotton Famine.

3. Economics of diet. By Dr. E. Smith.

DR. EDWARD SMITH'S REPORT on the NOURISHMENT of the DISTRESSED OPERATIVES.

Page. Summary of the Report.

TO REPORT UPON—

324 1. The minimum allowance for food to maintain health.
2. The best mode of expending it.
3. „ „ 25 to 50 per cent. additional.

LEADING FEATURES OF THE REPORT.

1. *The Principles of Dietary.*—Application of the most recent knowledge, having reference to the former habits of the people, including labour, income, food, and degree of health ; also to the season of the year, and the influence of excretion, temperature of the food, flavour, cooking, proportion of nitrogen to carbon, vegetable juices, fat, age, and sex, and the distribution of food during the day. Also the economic and nutritive value of each article of food referred to ; viz., bread, flour, oatmeal, peas, rice, sago, barley, potatoes, turnips, carrots, other succulent vegetables, sugar, treacle, butter, lard and dripping, bacon, meat, bones, liver, herrings, milk, butter-milk, cheese, tea and coffee, chicory, beer, and eggs.
2. Authentic detailed statements of the articles of food used by the single and married operatives in ordinary times and at present in their dietaries, with the cost and nutritive value of each article and of the whole.
3. Collection of about 90 formulæ of cooked food now being supplied, with the wholesale price, and nutritive value of each article and of the whole ration ; all being reduced to a common quantity for comparison.
4. Fifty formulæ now devised and recommended for dietaries. Some for each meal separately to cost not more than 1½*d.* for breakfast, 2*d.* for dinner, 1*d.* for tea, with their nutritive values, and a comparison with the nutriment required by the system ; others for weekly selection of food at a given cost and nutriment.

All the formulæ are based upon an estimation of the real amount of nutriment which is now required by these populations ; viz., 30,100 grains of carbon and 1,400 grains of nitrogen weekly.

Minimum allowance weekly for food:

For single men, 2*s.* 6*d.* ; single women, 2*s.* 3*d.* ; married couples, without children, 4*s.* 9*d.* ; married couples, with children, 4*s.* 6*d.* ; children over 12, 2*s.* ; under 12, 1*s.* 6*d.* ; child at the breast (if the only child), 1*s.*

When supplied with cooked food at the wholesale price, over 16, 2*s.* ; over 10, 1*s.* 6*d.* ; under 10, 1*s.* 3*d.*

ORDINARY HABITS OF THE POPULATION.

324 In ordinary times.
Labour.—Caused 1½ to 2 times that at rest. Not much less now.
Income.—4*l.* to 15*s.* for whole family.
Food.—Of a number of cases, single persons spent 5*s.* 7*d.* ; families, 2*s.* 7½*d.* per head. Fond of tea and coffee, also of the carbo-hydrates and fatty matters, as bread, sugar, and butter. Some single women ate 1½ lb. of butter and sugar weekly.
Health.—Not equal to other classes. More anæmia, less assimilation.

Cold Season.—Is a powerful vital excitant, and aids assimilation of the cheaper foods, as the carbo-hydrates. The hot season will call for more nitrogen, and be attended with greater liability to fever and diseases from defect of food.

Estimation of Food to maintain Health :—

Ordinary Habits.—These tend to excess.

Daily Excretion and Evacuation.—Carbon from 7·85 oz. to 12·19 oz. ; medium, 9·11 oz. ; nitrogen, 200 grains.

Aspect.—*Bulk of Body* is generally a good test.
Colour of Skin is generally a good test if increasing.
Colour of Gums and Mucous Membrane, ditto, ditto.
Firmness of Muscles.—Muscles rather flabby at all times.
Spirits.—A valuable but not reliable test.
Capability for Exertion.—A good test if actually at work.

APPENDIX.

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Summary of the Report.

Actual Experience of these People.—Twenty-five single persons now spend 2*s.* 4½*d.*, 31 families now spend 1*s.* 9*d.* per head weekly; 10 single persons did spend 5*s.* 4*d.*, now spend 2*s.* 5*d.*; nine families did spend 2*s.* 11*d.*, now 1*s.* 10*d.* per head.

Record of Health.—Now generally good at this cost of dietary. 2*s.* weekly is the dividing line between sufficiency and insufficiency.

GENERAL RÉSUMÉ FOR THE ANSWER TO QUESTION 1.

333 *The Quantity of Food is satisfactory* if the bulk of body, strength, colour, appetite, and spirits are as good as usual.

Labour.—The present variation is not important.

Season.—Is favourable.

Sex.—$\frac{1}{10}$th less food and cost for women. Women need more nitrogen in proportion to body weight.

Age.—Much food required at the never-returning period of growth. The young and old need much nitrogen.

335 BEST MODE OF PUBLIC RELIEF.

Money, cooked and uncooked foods.

336 PRINCIPLES INVOLVED.

Fluids.—Too much will increase waste, also increase the urea and rate of pulsation; the ordinary limit is 2½ pints.

Evacuation of Bowels.—Every second day. Frequent dejection carries off nutritive material. Bran, husk of oatmeal and shells of peas carry off food. Prisoners eating brown bread pass 10 oz. of fæces daily, while in ordinary life the quantity is 4 oz.

Variety of Food.—To keep up the appetite and relish for food and the assimilation.

Hot Food.—To supply heat and to stimulate vital actions.

Flavour of Food.—To be varied in a series of three days if one kind of food only be supplied, to sustain the relish.

Existing Tastes to be respected at present. Continue the tea and coffee, although they are not economical foods.

Cooking is bad. The women work in the mills and pay for cooking. Utensils and firing deficient. They desire sapid worthless food on account of the heat of the factories.

Nutritive Elements.—*Nitrogen* is a vital stimulant as well as a flesh-former. In *bread* it is $\frac{1}{22}$, in *milk* $\frac{1}{12}$. The latter used for the young, the former for the adult, supplemented with meat. The necessary quantity of *meat* is uncertain. Masses of people do not taste it, and vegetarians live without it, and yet both remain in apparent health. Very advantageous in small quantities, and some kind of animal food is essential.

Cheese promotes digestion, but is itself imperfectly digested, and is therefore less valuable than its components indicate.

Salt.—Too much lessens the carrying powers of the blood, and thereby limits vital action. It also demands the drinking of water, and this also excites waste.

Fresh Vegetables.—Multitudes do not now eat them, and yet they remain in health. Scurvy is due to the absence not only of these, but of fresh meat and other good food. Potatoes are a dear food.

Fat is much dearer than starch, which has the same components, only in less quantity. Do not know why both are necessary. Fat probably has a physical action and lessens elimination, and increases force of the heart, thereby increasing capillary vital action. Starch either does not do these or does them in a much less degree. A mixture of the two seems necessary, even in the most rigid dietary.

Age.—The young must have milk. Skimmed milk and butter-milk is the cheapest food.

Sex.—Females, nursing mothers, the young and the old, demand more nitrogen.

Distribution of Food during the Day.—A good breakfast and a good early dinner are required. In the morning the system needs food and rapidly digests it. The weight of the body increases progressively during the day, and in the evening fluid is required to aid excretion.

APPENDIX.

V. The Cotton Famine.

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345 ECONOMIC AND NUTRITIVE VALUE OF FOODS.

Existing analyses are insufficient. Must take averages from fair samples, as of a whole beast, for example, in reference to meat. Refer to the carbon and nitrogen only for comparison with the excretions. Quote the free hydrogen, also reckoned as carbon.

Food.		Cost.	Carbon.	Nitrogen.	Remarks.
		d.	grains.	grains.	
Bread - -	lb.	1½	1,968	92	
Flour - -	lb.	1¾	2,656	120	Multiply by 1·4 to find the quantity of bread.
Oatmeal - -	lb.	1¾	2,768	140	
Peas - -	lb.	1½	2,688	252	3 times cheaper than bread in carbon; ⅓ times cheaper than bread in nitrogen; but not equally assimilated.
Rice - -	lb.	1½	2,688	70	Cheaper than flour if 1*d.* per lb. Must eat more.
Sago - -	lb.	- -	2,552	1·7	
Barley - -	lb.	2	2,656	91	
Potatoes - -	lb.	⅝	760	24	Requires 3½ times to be equal in carbon to flour; 5 times to be equal in nitrogen to flour; 10½ times to be equal in nitrogen to peas.
Turnips, swedes -	lb.	½	304	15·3	
„ white -	lb.	- -	175	1·2	
Carrots - -	lb.	½	384	14	
Succulent vegetables -		- -	420	14	
Sugar - -	lb.	4½	2,768	- -	Much dearer than starch, with equal nutritive values.
Treacle - -	lb.	1½	2,240	- -	Much cheaper than sugar.
Butter, fresh -	-	- -	4,704	- -	A very dear fat.
„ salt -	-	- -	4,584	- -	
Lard and dripping	-	- -	5,320	- -	
Bacon, green -	-	4	4,265	78	The cheapest fat.
„ dry -	-	- -	4,753	96	
Meat, average for these dietaries.		- -	2,580	160	
Bones (for liquor)	lb.	1¼	783	24	
Liver - -		- -	1,226	210	
Herrings, dried -	lb.	- -	1,435	840	The cheapest animal food if it were more digestible.
Milk, new -	pint	1 to 1½	546	43	
„ skimmed -	pint	½ to ¾	438	43	Is equal to new milk when fat is added.
Butter-milk -	-	¼	420	43	
Cheese - -	-	5	2,657	316	
Tea - -	oz.	3	- -	10	
Coffee - -	oz.	¾	- -	5	
Eggs, weight 1¾ oz. each.		½	166	15⅓	

359 PRIVATE DIETARIES.

Selected from single persons and from large families of moderately thrifty habits. Those from single persons are the most valuable, since in families the age and wants of the children vary much.

Now there is less quantity of food eaten, and particularly of potatoes, sugar, butter, meat, and milk, and there is much less of bacon and tea. Bread is the chief food. Treacle and oatmeal are more eaten.

Daily average Food—

Men -	carbon 4,588 grains;	nitrogen 215 grains.
Women -	„ 3,758 „	„ 155 „

Formerly the quantity was excessive amongst single persons. One woman ate 8,500, four others above 7,000, and 13 above 5,000 grains of carbon. The quantity is now reduced in the same persons from 8,500 to 4,826, and from 6,179 to 2,783, and yet they maintain good health. This proves the tolerance of excess in the system.

The lowest Dietary offers 2,742 grains of carbon and 99 grains of nitrogen. There are 82 tables, divided into three series.

1. Separate persons, male and female, in each town.
2. Married persons without children.
3. „ „ with 1 to 11 children.

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PUBLIC DIETARIES.

Some give the food, others sell it, and a few sell it at a profit. There is great variation in the cost and nutriment of the ration.

	Carbon.	Nitrogen.
In soups the extremes are -	300 to 1,795 grains.	12 to 84 grains.
In potato hash and pie „ -	491 „ 2,884 „	25 „ 109 „

Potato pie, rice milk, rice pudding, porridge, tea, and coffee are supplied.

The required Nutriment for each Meal is—

Breakfast -	carbon 1,500 ;	nitrogen 70	grains.
Dinner - -	„ 1,800 ;	„ 90	„
Tea - -	„ 1,000 ;	„ 40	„

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THE PROPOSED DIETARIES.

Model Dietary—

To cost 1½*d.* or less.	Breakfast—milk, oatmeal, bread, fat, with bacon or herring, if possible.
„ 2*d.* „	Dinner—meat, bacon, or herring, bread, vegetables, and cheese, or pudding, if possible.
„ 1*d.* „	Tea—tea, coffee, milk, oatmeal, bread, and fat.

All composed of the ordinary foods, and of good quality.

Dietaries for Single Meals:—

For breakfast there are	10 formulæ,	at a cost of	1*d.* to 1½*d.*
„ dinner „	13 „	„	1¼*d.* „ 2*d.*
„ tea „	5 „	„	1*d.*

All offering sufficient carbon and nitrogen, varying with sex and age.

For soups there are four formulæ, each to cost, with 5⅓ or 6 ounces of bread, 1½*d.* to 1¾*d.*, and having without the bread—carbon, 841 to 1,201 grains; nitrogen, 46 to 61 grains. All contain 2 to 2½ ounces of raw meat, besides bone, and with the bread offer sufficient nourishment for the dinner.

Weekly Dietaries.—These are less valuable than those for single meals, from the variety of tastes and habits of the people. The cheapest foods, number of meals, and the foods selected. 2*d.* weekly allowed for fresh vegetables, which will buy 4 lbs. of potatoes, &c.

The weekly cost varies from 1*s.* 11¾*d.* to 2*s.* 7½*d.* under Question 2.
„ „ 2*s.* 8*d.* to 4*s.* „ „ 3.

The weekly nutritive values vary from—carbon, 26,332 to 41,943 grains.
„ „ „ nitrogen, 1,154 „ 1,835 „

When tea and coffee are supplied the nutriment is lessened at the same cost. The last table offers great variety and articles of food at a higher price, but all provide for a suitable distribution of food for the three meals, and a suitable combination of foods to be eaten together. Meat or bacon, not exceeding 2 ounces uncooked, is supplied daily in nearly all the formulæ.

REPORT.

Letter of instructions.

ON December 2nd, 1862, I had the honour to receive from the Medical Officer of the Privy Council a letter in the following terms:—

> "The Lords of Her Majesty's Council, having under their consideration (so far as relates to health) the present distressed circumstances of the unemployed factory populations in the north of England, and wishing to satisfy themselves as to the sufficiency of the various local allowances and arrangements for the provision of food for destitute families and persons among those populations, direct me, with a view to this object, to request that you will have the goodness to visit the towns of Manchester, Ashton-under-Lyne, Wigan, Blackburn, Stockport, and Preston, and, after such local inquiry as you may find requisite, report to me for their Lordships' information your answers to the subjoined questions."

Questions proposed.

"QUESTIONS."

"At the named places, and at current retail prices, and distinguishing the case of separate persons from that of members of families, "and having regard to the season of the year as well as to the habits "of factory populations in ordinary times,—

1. "What is the least cost per head per week for which food can be "bought in such quantity and in such quality as will avert starvation-diseases from the unemployed population?

2. "What, with special reference to health, would be the most "useful expenditure of a weekly minimum allowance granted exclusively for the purchase of food?

3. "What, with the same special reference, would be the most "useful expenditure of small additional sums, say 25 and 50 per cent. "on the minimum granted for the same exclusive purpose?"

Nature of the inquiries.

I have now the honour to report, for the information of Her Majesty's Council, that I have visited the above-mentioned towns, and have carefully inquired into—

The composition of the cooked foods supplied by the various public bodies, the employers of factory labour, and various private organizations established in whole or in part for that purpose.

The wholesale and retail prices of foods.

The precise dietary of the factory operatives, whether of separate individuals or of families, in ordinary times of abundance, and at the present period of privation.

Acknowledgments for aid in the inquiries.

In prosecuting these researches with the requisite rapidity I have necessarily been indebted to numerous gentlemen who have enabled me to obtain the required information, and I desire especially to offer my acknowledgments to Dr. Eason Wilkinson, Dr. Ogden Fletcher, and Mr. David Machaffie (J. Pender and Co.) of Manchester; to Messrs. Lea, junior, and Meek of Wigan; to Dr. Arminson and Messrs. Ascroft and Meek of Preston; to the Rev. Dr. Robinson and Messrs. Thompson and Dean of Blackburn; to the Mayor of the manor of Ashton-under-Lyne and Mr. Galt; to Mr. Alfred Aspland of Dukinfield; and to Dr. Turner, and the Rev. John Evans, of Stockport. It is also right to add that, with only two exceptions, the required information has been freely and cheerfully given.

My best thanks are due to Messrs. Lawes and Gilbert, FF.R.S., for their various analyses of foods.

QUESTION 1.

Preliminary Questions.

QUESTION 1.—"WHAT IS THE LEAST COST PER HEAD PER WEEK FOR WHICH FOOD CAN BE BOUGHT IN SUCH QUANTITY AND IN SUCH QUALITY AS WILL AVERT STARVATION-DISEASES?"

Before answering the first question which has been proposed to me, it will be needful to offer some observations upon the circumstances which have been cited as conditions of the inquiry, such as those affecting the ordinary habits of these populations and those appertaining to their ordinary degree of health.

Habits of factory operatives.

1*st.* *Circumstances connected with the habits of the factory populations in ordinary times and at present.*

Labour.

Labour.—In ordinary times the labour which is exacted from these populations is chiefly that of maintaining the body erect and of walking a little at short intervals during about ten hours daily. The duty is that of watching machinery rather than of manual labour, such as that of raising or carrying weights. Mr. T. C. Horsfall has computed, from careful observation, that the spinners walk or run about 1⅓ miles per hour. This would cause an increase of vital action of from about one half to double of that which is found at rest, for in experiments performed upon myself I found that the activity of the respiratory function in the quiet lying posture being represented by 1, that in the sitting posture was 1·18, in the standing posture 1·33, and in walking at the rate of 1 mile per hour 1·9.

At the present time a large proportion of these persons are without fixed occupation of any kind, but they wander about the streets and induce an amount of vital change, probably as great as that which occurred in their ordinary labour, whilst others pursue the laborious occupation of breaking stones, and others still spend a large portion of the day with the least amount of vital change in the sewing schools and educational classes. Whilst therefore there is some diversity in the conditions both in ordinary and present times, it may be affirmed that their ordinary and present occupations induce but little comparative increase in the waste of the body.*

Income.

Income.—The wages of the operatives in ordinary times vary very much, so that whilst in the fine spinning a good workman with some assistance may earn from 2*l.* to 4*l.* weekly, in the coarser departments from 15*s.* to 18*s.* is the usual weekly return. Single women obtain from 8*s.* to 20*s.* per week, and every child above 10 years of age may earn several shillings per week; so that in these populations, the man with a large family still living with him has a much larger income than the one without children, and instances came under my notice where upwards of 5*l.* per week is earned by a family. It is, however, the custom for the young man or woman residing at home to pay a fixed sum to the father for board and lodging, and thus to have and enjoy independent resources. Hence in ordinary times the amount of money at their command is abundant for all their wants, and whilst there is doubtless a sufficient quantity of food obtained, and some live very extravagantly, there is not so large an amount spent upon it as the total income might lead us to expect.

Food.

Food.—The following are a few examples of the weekly amount spent for food, exclusive of beer, in ordinary times:—

TABLE No. 1.

MANCHESTER.

Weekly income and expenditure for food, Manchester.

No.	Name, Age, &c.	Weekly Income.			Expenditure per Head for Food.		
		£	*s.*	*d.*	£	*s.*	*d.*
†42	J. A. and wife, aged - - - -	1	10	0	0	5	10
68 & 69	J. M'D., wife, and 5 children, eldest aged 8 years	-		-	0	2	6½
76	L. B., wife, and 6 children, eldest aged 11 years	0	17	0	0	1	7¼
77	T. H., wife, and 6 children, eldest aged 22 years	2	8	0	0	3	2½
82	M. N., wife, and 7 children, eldest aged 17 years	2	11	8	0	3	5¼
47 & 48	A. P. and 2 children, eldest aged 7 years -	-		-	0	2	7¼
—	E. M., wife, and 5 children, eldest aged 14 years	1	0	0	0	3	0
—	P. M., wife, and 5 children, eldest aged 12 years	0	16	0	0	2	0
—	R. L. and son - - - - -	1	6	0	0	6	3
10	H. B. and 1 child, separate (saved 40*l.*) -	0	10	0	0	4	5½

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* The fatigue which occurs in the factory is less due to exertion and increase of vital change than to exhaustion and defective assimilation attendant upon long continuance of the standing posture and heated rooms.

† The Nos. refer to the tables inserted at page 374 *et seq.*, and the same No. wherever found indicates the same person.

TABLE No. 1—*continued.*

Weekly income and expenditure for Wigan. Preston. Blackburn. Ashton. Stockport.

No.	Name, Age, &c.	Weekly Income.			Expenditure per Head for Food.		
		£	*s.*	*d.*	£	*s.*	*d.*
	WIGAN.						
63 & 64	P. L., wife, and 4 children (5 adults)	2	0	0	0	5	1
12	S. J. H., aged 20, female	-	-	-	0	6	2
	PRESTON.						
15 & 16	Mary R., aged 19	-	-	-	0	4	6¼
17 & 18	Ann C.	0	11	0	0	6	6
—	Bridget G.	0	15	0	0	7	10½
19	Mary M'C.	0	9	0	0	6	7
	BLACKBURN.						
80 & 81	M. H., wife, and 7 children, eldest aged 14 years.	-	-	-	0	1	5¾
—	J. T., wife, and 3 children	1	10	0	0	2	5
—	J. A., wife, and 3 children	1	10	0	0	2	0
	ASHTON-UNDER-LYNE.						
30	H. B., aged 20, female	0	10	6	0	5	4
31	S. H., aged 20, female	0	10	0	0	5	10½
74 & 75	J. M., wife, and 6 children, eldest aged 14 years.	1	17	0	0	2	4½
61 & 62	W. M., wife, and 4 children, eldest aged 18 years.	1	8	0	0	2	10¾
53 & 54	A., wife, and 3 children. eldest aged 19 years.	2	2	0	0	3	0
86 & 87	E. O., wife, mother, and 11 children	3	0	0	0	3	5
	STOCKPORT.						
79	J. L., wife, and 7 children, eldest aged 17 years.	2	0	0	0	2	5
72	R. T. and 7 children, eldest aged 25 years	2	10	0	0	2	10
36	E. A., aged 20, female	0	10	0	0	4	3¼
38	A. W., aged 18, female	0	13	0	0	3	4

Average expenditure for food.

These instances are too few to afford a satisfactory average, but they prove that in ordinary times those who were single spent per head weekly upon food 5*s.* 7*d.*, those living two in a family about the same, and those with families 2*s.* 7½*d.*

Kind of food preferred.

It is also to be remarked that, in reference to a large part of these populations, the quantity of meat and milk consumed is disproportionately small to that of bread, butter, and sugar. In a large number of instances there is provision made for the supply of a low-priced dinner to the operatives, by which two ounces of meat and about one pound of potato are taken into the mill at the dinner hour for a charge of 3*d.*, and of this many of the single persons living separately partake; but the total quantity of meat supplied to the families at home is not large. Thus, in the case already cited, No. 82, with a large weekly income, the quantity of meat and bacon consumed per week was only 1 lb. per head, and that of milk was less than half a pint, whilst that of bread, flour, and oatmeal, reckoned as bread, was nearly $12\frac{1}{2}$ lbs. Butter and sugar are eaten largely, some single women eating from 1 lb. to $1\frac{1}{2}$ lb. of each per week, and tea or coffee are commonly taken twice or thrice a day. The tables to be found on page 374 *et seq.* show that as a whole these populations eat much of the hydro-carbons or heat-forming foods, and drink largely of weak infusions of the excitants of vital action,—tea and coffee, whilst the proportion of the higher nitrogenized foods taken by adults is comparatively small. I was also informed by the operatives themselves, and it is commonly reported, that meat, and perhaps milk, are eaten more abundantly, or even exclusively, on Saturday night, Sunday, and Monday, and are not evenly distributed over the week.

Health.

Health.—The impression produced upon my mind by observation of the individual operatives in reference to the degree of health which they possess in ordinary times is that it is not equal to that of other populations. The countenance, gums, and tongue are pale, the cheeks somewhat flat, the body not fleshy, and the muscles flabby, whilst the endurance of fatigue is less than that of those who live and labour in the open air. Indeed it is of common observation that under existing circumstances the evidences of higher health are presenting themselves in the colour of the skin and the blood, a circumstance which is due doubtless to the absence of the heated rooms in which they live in ordinary times, to a greater exposure to the free atmosphere, conjoined with a sufficiency, although a diminished quantity of food. Defective assimilation, and consequently excessive elimination, appear to me to mark these populations as a whole.

Influence of season.

2. *The influence of the season of the year on the necessary quantity of food.*

The supply of food is essentially associated with that of clothing and housing in relation to the external temperature of the air, but as the latter are not included in my inquiry, I must assume that protection from the cold is so far afforded that no serious defect exists.

In my researches into the influence of season of the year over the vital actions, it was shown that in the winter season there is a large amount of respiratory action, an amount inferior only to that which occurs in spring, whilst the evolution of urea was not greater in the winter than in the summer. Hence it is necessary that there should be during the winter season a large supply of the hydro-carbons or the heat-forming foods, the products of which for the most part pass out by the lungs, whilst there is reason to believe that there is less necessity for the nitrogenous foods in winter than in summer. Without entering at length into the latter question, I may observe that nitrogenous foods are useful to the system, not only to supply nitrogen to repair the waste of the animal tissues, but as excitants of vital action, whereby the transformation of the carbo-hydrates is promoted; and as in winter the low temperature is of itself a constant and most powerful excitant of vital action, other excitants are less needed, whilst in summer the heat lessens the respiratory functions fully one-third of the winter amount, and the action of nitrogenous foods is imperatively called for. In reference, therefore, to the season to which this report more particularly refers, we are justified in affirming that it demands a large supply of the starchy and fatty food—of that food which, as has been stated, these populations chiefly partake.

3. *The mode of estimating the amount of food necessary to maintain health.*

Estimation of food sufficient to maintain health.

The term employed in the question now about to be discussed is the averting of "starvation diseases;" by which I understand the maintenance of a degree of health equal to that of any other class of the community where the supply of food only suffices to meet the requirements of the body.

We may seek to estimate this amount in various ways :—

From ordinary amount of food.

A. The quantity of food ordinarily consumed when an admitted sufficiency can be obtained.

The importance of this method is very great, since by it, as a last resort, we must estimate all theoretical assertions, yet it fails in the two opposite directions, only one of which, viz., that of excess, need be referred to here. As there is a power inherent to the body, by which it refuses to receive or rids itself of excess, within certain limits, more food may be taken than is necessary to the system, and with the desire to please the appetite, and perhaps the influence of routine habits, an excess is common with those who can obtain it. Hence we may not accept as a standard the habits of mankind, unless it can also be proved that a lower scale of dietary will not sustain health.

From daily waste in the excretions.

B. The amount of the products of daily waste issuing from the body.

The two directions in which this may be sought are the respiratory and the urinary functions; the former eliminating chiefly the products of the hydro-carbons, and the latter those of the nitrogenous substances.

Carbon.

The amount of carbon emitted by the lungs daily varies greatly in different persons, and particularly with different amounts of exertion, and has been variously estimated by observers at from 6 to $13\frac{1}{2}$ ounces, which would require so great a diversity in the amount of bread to supply it as 20 ounces and $44\frac{1}{2}$ ounces. In a series of experiments, extending over the whole day and on several days, which I performed upon myself and others, I found that in quietude 7·85 ounces; in moderate labour, 9·11 ounces; and in considerable labour, 12·19 ounces of carbon were expired,—quantities demanding 26 ounces, 30 ounces, and 40 ounces of bread to supply them.*

Nitrogen.

In reference to the nitrogenous elements which pass out of the body, and chiefly by the kidneys, I do not think that in the present state of our knowledge the quantity could be used for the purpose in hand, for it has now been abundantly proved that the relation of urea (the chief compound of nitrogen in the excretions) is as the quantity of nitrogenous food taken, and not as the necessary waste of the animal tissues; and therefore the problem is carried back in the circle to the quantity of nitrogenous food which should have been taken simply to supply tissue waste.

Excretion from the bowel.

It must also be borne in mind that under every condition of health there is a portion of unused food passing off by the bowel, and this is commonly increased as the food is in excess or is poor in nitrogen, and the assimilation defective.

Value of evidence from the excretions.

Regarding therefore the variations in the amount of excretion in different persons with the necessary diversity of conditions, and the impossibility of estimating their influence accurately, I think that only a limited value could be assigned to the determination of a supposed necessary quantity of carbon. That the determination of the excretion of nitrogen can only be a true guide when the very problem

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*Philosophical Transactions, 1859 and 1861.

which we seek to solve by it has been otherwise solved by the determination of the *necessary* quantity of nitrogen to meet true tissue waste, and that the refuse matter in the fæces will vary on the one hand with excess of food, and on the other with want of assimilation and appropriation of food, and not bear any necessary relation to necessary food,—I cannot use this method of estimating the amount of food simply necessary to maintain health, except in a general manner. I have elsewhere shown* that in middle life the daily excretion of carbon by the lungs is 25 grains to each lb. of body weight, and that of nitrogen is ·934 to 1·4 grains to the same proportion. Hence an ordinary sized man, one weighing 150 lbs., would emit 3,750 grains of carbon, and, say, an average of 170 grains of nitrogen ; and if we add an average quantity of those elements found in the fæces, the total quantity of carbon will be upwards of 4,000 grains, and of nitrogen about 200 grains daily.

Daily amount of carbon and nitrogen required.

C. The evidences derived from the aspect and general appearance under a reduced dietary.

General appearance with a reduced dietary.

This is a method of great and practical importance, for it is that by which men in general estimate health, and is only amenable to the higher tests of resistance against disease and prolongation of life. These higher tests cannot in the nature of things be applied at any particular moment, since the conditions of system which tend to disease are commonly of slow growth, and are manifested step by step. They are, so to speak, the result of accumulating influences, for as each step is taken it gives itself a momentum which carries the system on to the next step in its downward course. Hence whilst the evidences of health may exist, it is only by lapse of time that we are enabled to prove that they will be permanent. At the same time, if they have existed for some months and are not diminishing, but on the contrary, perhaps increasing, there is a high presumption that the condition is truly one of health.

The evidences upon which we may the most rely are :—

Bulk of body.

The bulk of body.—The almost invariable effect of deficiency of food is diminution in the bulk of the body, both in its fluid and solid parts, and of its nitrogenous and non-nitrogenous elements. Yet conditions of ill health exist with a dietary deficient in nitrogenous elements in which the fluids of the body are more than enough, and the fat is sufficient, as were formerly seen in Ireland ; but such are quite exceptional, and the conditions more nearly allied to those now under discussion are such as occur with famine, and are somewhat rapid in their progress, rather than those attending long-continued idleness and excess of one element of food.

Colour of skin.

Colour of skin.—This is not a certain test, except it be a comparative one, since many persons, and particularly factory operatives, are pale in complexion ; but when the colour has increased it may be accepted as evidence of improved health.

Colour of gums and mucous membranes.

Colour of the gums and mucous membranes.—This is probably associated with the last, but is an earlier and more reliable proof. With pallor the blood is defective in quality, and with increase of colour the blood improves.

Firmness of the muscles.

Firmness of the muscles.—This is so much associated with the use of the muscles that it cannot be taken as evidence of simple health in the class of persons under inquiry, since it will exist in only a very moderate degree in the ordinary degree of health. Its continued presence, perhaps, always indicates vigorous general health.

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* Health and Disease as influenced by the Cyclical Changes in the Human System. Walton and Maberley, 1861.

APPENDIX.

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3. Economics of diet. By Dr. E. Smith.

Preliminary Questions.

Elasticity of spirits.

Elasticity of the spirits.—This has only a general significance, since its absence may be due to mental rather than to bodily causes, and its presence often occurs in sensitive and not robust or healthy organizations, as, for example, in consumptives.

Capability for exertion.

Capability for exertion.—This is a very good test of health when the person is actually engaged in it, but is not to be relied upon when the labour is in anticipation. Thus, with a given amount of food, the opinion of an unemployed person as to his capability for exertion is only valuable so far as it may be supported by other evidences, and whilst the belief of the individual, if honest and cautious is entitled to much consideration, it is not a reliable guide.

Actual experience of the operatives in times of plenty and of scarcity contrasted.

D. The evidence derived from the actual experience of the operatives under the past and present circumstances.

There is some difficulty in comparing the cost of the dietaries in two different periods, from the facts that the prices of the foods have varied much in the interval of one or two years, and that in families the growth of the children demands that more food should be given at the present than at any previous period. I have obviated the former by quoting the present price of the foods of the quality which was formerly preferred; but the latter I have been obliged to leave, and hence the contrast in favour of the amount of reduction under the present dietary is really greater than the figures indicate. Another qualification, but one acting in the opposite direction, must also be premised, viz., that at the present time foods of a less price, or, in the market-estimate, of inferior quality, are now bought, but, it may be, without their nutritive value being materially lessened. Thus, formerly butter was bought at 1*s.* and 1*s.* 2*d.* per lb., bacon at 8*d.*, meat at 8*d.*, sugar at 6*d.*, cheese at 8*d.*; whereas the same foods of a lower market value are bought at 8*d.* or 10*d.*, 4*d.*, 6*d.*, 4½*d.*, and 5*d.* in their order, and thereby with a diminished income the operatives are still able to obtain these foods.

Weekly cost of food ordinarily and now.

Manchester.

The following is a list of persons, with the weekly cost of food at the present time, exclusive of beer, compared, in many cases, with the cost in ordinary times, the particulars of which will be found on pages 374 *et seq.*

TABLE No. 2.

MANCHESTER.

No.	Name.	Number of Persons.	Cost of Food ordinarily.				Cost of Food now.			
			Per Family.		Per Head.		Per Family.		Per Head.	
			s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
*43	J. A. -	2, aged - -	-	-	5	10	-	-	2	0¾
68 & 69	J. M'D. -	7, young children -	17	3	2	5¼	8	5	1	4
76	L. B. -	8, „ „ -	11	8	1	5½	5	4½	0	9¼†
67	„ -	7, without the husband	-	-	-	-				
11	M. W. -	1, aged 19, female -	-	-	-	-	-	-	3	0½
47 & 48	A. P. -	3, young children -	7	9¾	2	7¼	5	1½	1	8½
—	E. M. -	7, „ „ -	20	11	3	0	11	2	1	7
		WIGAN.								
63 & 64	P. L. -	6, 5 adults - -	30	5	5	1	13	5½†	2	3
13	S. T. H. -	1, female - -	-	-	6	2	-	-	3	1¾

Wigan.

* The numbers refer to the tables, and indicate the same person wherever found in this report.

† Including soup.

TABLE No. 2—*continued.*

PRESTON.

Preston.

No.	Name.	Number of Persons.	Cost of Food ordinarily.				Cost of Food now.			
			Per Family.		Per Head.		Per Family.		Per Head.	
			s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
*15 & 16	M. R.	1, female	-	-	4	6¼	-	-	3	3½
20	A. H.	1, aged 20, female	-	-	-	-	-	-	1	9
21	A. D.	1, „ 17 „	-	-	-	-	-	-	2	0¾
22	E. M'K.	1, „ 18 „	-	-	-	-	-	-	1	11¾
23 & 24	A. R.	1, „ 21 „	-	-	4	4	-	-	2	2
25	B. F.	1, „ 21 „	-	-	-	-	-	-	1	10
26	H. R.	1, „ 20 „	-	-	-	-	-	-	2	0
5	H. T.	1, „ 18, male	-	-	-	-	-	-	3	6½
6	J. N.	1, „ 21 „	-	-	-	-	-	-	3	2½
7	R. H.	1, „ 21 „	-	-	-	-	-	-	1	11½
8	T. L.	1, „ 18 „	-	-	-	-	-	-	2	11
56	— W.	5,	-	-	-	-	11	4¾	2	3½
57	M. B.	5, young children	-	-	-	-	6	6½	1	4¼
84	M. D.	11, „ „	-	-	-	-	10	9½	1	0¼
17 & 18	A. C.	1, female	-	-	6	6	-	-	2	3½
19	M. M'C.	1, „	-	-	6	7	-	-	1	7
14	M.A.M'G.	1, „	-	-	-	-	-	-	2	2½*
		BLACKBURN.								
80 & 81	M. H.	9,	13	3	1	5¾	12	6¾	1	4¾
55	A. B.	5, adults	-	-	-	-	5	1½	1	0¼
79	– L.	8, young children	-	-	-	-	10	6¼	1	3¾
27	A. M.	1, aged 39, female	-	-	-	-	-	-	2	10¼
		ASHTON-UNDER-LYNE.								
33 & 34	S. W.	1, aged 39, female	-	-	6	6	-	-	2	10
29 & 30	H. B.	1, „ 20 „	-	-	5	2	-	-	2	2
31 & 32	S. H.	1, „ 20 „	-	-	5	10½	-	-	3	2½
74 & 75	I. M.	8, young children	19	0½	2	4½	13	8¾	1	8½
61 & 62	W. M.	6,	17	4¼	2	13¾	10	3¾	1	8½
51	– L.	4,	-	-	-	-	10	1¾	2	6½
53 & 54	– A.	5, grown children	15	0	3	0	14	0½	2	9¾
86 & 87	E. O.	14, all grown	50	8	3	7½	32	9½	2	4
83	– O.	10,	-	-	-	-	15	3½	1	6¼
—	L. N.	4, young children	-	-	-	-	9	0	2	3
46	J. M.	3, adults	-	-	-	-	6	4	2	1½
70	J. B.	8,	-	-	-	-	15	0	1	10½
85	T. B.	12,	-	-	-	-	21	0	1	11
78	J. K.	9,	-	-	-	-	21	8½	2	5
44	R. W.	2,	-	-	-	-	3	5½	1	9½
9	W. S.	1, male	-	-	-	-	-	-	2	2
58	R. W.	6,	-	-	-	-	10	9	1	9½
52	J. W.	5, young children	-	-	-	-	8	3½	1	8
71	R. C.	8, „ „	-	-	-	-	9	1	1	1¾
45	J. M.	2,	-	-	-	-	6	0	3	0
28	– S.	1,	-	-	-	-	-	-	3	2
35	M. C.	1, female	-	-	-	-	-	-	2	0
65	W. G.	7, young children	-	-	-	-	11	7	1	7¾
50	J. E.	4, grown „	-	-	-	-	9	0	2	3
66	T. H.	7, young children	-	-	-	-	14	0	2	0
60	M. B.	6, „ „	-	-	-	-	9	1	1	6
59	T. L.	6, „ „	-	-	-	-	10	4½	1	8¾

Blackburn.

Ashton-under-Lyne.

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* The numbers refer to the tables, and indicate the same person wherever found in this report.

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Stockport.

TABLE NO. 2—*continued.*

STOCKPORT.

No.	Name.	Number of Persons.	Cost of Food ordinarily.		Cost of Food now.	
			Per Family.	Per Head.	Per Family.	Per Head.
			s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
36 & 37	E. A. -	1, female - -	- -	4 3	- -	1 10
38 & 39	A. W. -	1, ,, - -	- -	3 4	- -	2 10
40	S. H. -	1, aged 16, female -	- -	- -	- -	1 7¼

Average cost of food weekly.

From this table it appears that at the present time 25 single persons are spending on the average 2*s.* 4½*d.* each, and 31 families 1*s.* 9*d.* each head per week for food. Also that 10 single persons who formerly spent on the average 5*s.* 4*d.* each per week, now live upon 2*s.* 5*d.* each, and that nine families who formerly spent 2*s.* 11*d.* per head now spend only 1*s.* 10*d.* per head per week for food.

State of health and strength of the cases quoted.

Before making any application of these results, it will be well to refer to the state of health of such of these persons of whom I have records, so as to give due weight to their own opinions on that head.

Separate persons and families.

Weekly Cost of Food per Head.	No. of Case.	Remarks.
s. *d.*		
0 9¼	67	The income of this family was never very large, but it is now reduced to the minimum amount in the table, viz., 9¼*d.* per head, (the father, however, living apart from them). The children have not sufficient food, and are suffering from fever. The father lives on the food supplied by his employers, Messrs. Stirling, page 409. The breakfast consists of coffee and bread, and the dinner of potato hash or soup with bread, the cost of which to the employer is, breakfast 1*d.*, dinner 1·39 or 1·51*d.*, which will not, therefore, exceed 2½*d.* per day, and six days in the week, 1*s.* 3*d.* He is in his usual health and at work.
3 0½	11	Has had her present dietary for four months and remains well. She is not thinner.
1 8½	48	They are somewhat thinner and weaker, but without disease or change of appearance. She thinks they could not live always upon this dietary.
2 3	64	Can live and work upon their dietary. The health remains good.
3 1¾	13	The same as above.
2 2½	14	Looks well and the flesh firm. She thinks that she can live upon her dietary. Prefers bread to soup.
2 0¾	21	Says that she lives pretty well.
1 11¾	32	She had a very good colour of complexion.
1 3¾	57	All remain in very good health.
1 0¼	84	Lived for years in this way, and seem in tolerable health.
2 2½	34	She looks well and has no change in colour or in flesh, but she feels weaker, and could not work on her dietary.
2 2	30	Her colour is improved. She is not thinner, her spirits are not so good. She feels weaker, and could not work on this dietary; thinks 3*s.* 8*d.* weekly necessary for food when at work.
2 9¾	54	This is a careful family and had saved money, so that at the present time they are living nearly as well as formerly.
2 4	87	This very large family, nearly all grown up, look well and say that their health and strength are good, and that they could work upon their dietary.
2 10	39	This girl did not take meat when receiving high wages, and now considers that she is in very good health, and can work upon this dietary.

Preliminary Questions.

Weekly Cost of Food per Head.	No. of Case.	Remarks.
s. *d.*		
*2 4½	—	In good health and strength and able to work upon this dietary. Children are pale. A little loss of flesh.
2 1½	46	Health and strength good. Have lost flesh, but are fit for work.
1 10½	70	Suffer from want of food. Still the strength not diminished, and they are fit for work.
1 11	85	In health, flesh, and strength.
2 6	78	Want of food, loss of flesh and strength.
1 9½	44	Lost flesh, are pale and not quite so strong, yet in tolerably good health.
2 2	9	Lost flesh and strength, and are pale, yet in very good health.
1 9½	58	Fit for work, but somewhat thinner and weaker.
1 8	52	Parents strong and fit for work, not less fleshy. The children not quite so strong.
1 1¾	71	Lost flesh and health. Two children are very weak. Wife has lost flesh. Husband able to work.
3 0	45	Good health, flesh, and strength.
3 2	28	The same as above.
2 0	35	In bad health, and not fit for work.
1 7	65	All robust and in good health.
2 3	50	General good health, except the wife.
1 11½	66	All thinner, and not in good health.
1 5¾	60	The same as above.
1 8¾	59	Health is variable.

For the cases following the * I am indebted to the courtesey of Mr. A. Aspland of Dukinfield.

Summary.

The general impression which my own inspection of the persons referred to in this list, and that which a consideration of the remarks will give, is that hitherto a fair average state of health has been maintained upon the weekly allowances recorded. Where the amount has reached about 3*s.* per week there is no complaint recorded, and whilst in one case 2*s.* 6*d.* per week did not sustain the health and strength, there are scarcely any evidences of failing health when it exceeded 2*s.* per week per head. In one instance the weekly allowance was only 1*s.* 3¾*d.* per head, and yet the family remained in good health, but the children were young. In the case of single persons, 1*s.* 7*d.* and 1*s.* 9*d.* per week sufficed to maintain good health and strength, but in a majority of instances of that class the weekly allowance for food was from 2*s.* to 2*s.* 6*d.*

As typical families I would refer to No. 87, where 2*s.* 4*d.* for each head (the children having chiefly grown up) was quite sufficient, and to No. 64, where five adults and one child lived upon 2*s.* 3*d.* per head per week, and in both cases the families had been formerly accustomed to an abundant dietary. Of the single women, I would select Nos. 20 and 21, the former living on 1*s.* 9*d.*, and saving 3*d.* per week to redeem her clothes, and the other on 2*s.* 0¾*d.* with the best arranged dietary which I have met with.

Answer to Question 1.

Having thus discussed these preliminary matters, I proceed to answer the question which has been proposed to me.

Test of health.

I consider that amount of food to be satisfactory in reference to health, which is taken by one who does not lose flesh or strength, whose colour of skin and gums is improving, or (the person having been in moderate health) not diminishing, and whose appetite, digestion, and spirits are good, or as good as is usual.

Labour.

The influence of labour is unimportant in this inquiry, for the amount of exertion now made cannot be much less than that required in their ordinary occupations.

Open air.

They enjoy at the present time an advantage in moving in the open air and a cooler atmosphere, and there is much reason to believe that this enables them to live on food of a less nitrogenized quality than is required with their labour.

Season.

The influence of season is also, in like manner, not unfavourable to the same end, provided there be sufficient protection from the cold.

Sex.

The influence of sex is, I believe, less than is generally admitted, provided the aim be, as at present, to ascertain how little food either may take and yet remain in health; and whilst the heavier bodies of men demand a somewhat larger amount of food than those of women, the increase need not be large, and may be nearly restricted at the present time to the carbo-hydrates and fats. Under ordinary conditions of living there can be no doubt that men eat much more than women, and that they, more than women, take food in excess.

Age.

It is very probable that the necessities of age are imperfectly appreciated by the community. As the period of growth is restricted to a few years, there is a necessity for a much larger supply of food to the boy than to the man, in proportion to the weight of the body; and as each year has its own requirements, which cannot be transferred to another year, a defect of food at any period will cause an injury to be inflicted upon the system which may probably never be repaired. It has been computed* that the infant demands three times more carbon, and six times more nitrogen than an adult, in proportion to the weight of the body; and in boyhood the proportion of carbon required to body weight is 48 at 10 years of age, and 30 at 16 years of age, as compared with 23 in adult life.

In some of the remarks recorded on pages 8, it has been shown that at present the children suffer more than the father from the lessened supply of food, and hence the difference in the necessary cost of food for children in families, as compared with that required for youths who are old enough to live separately, is less than is practically admitted.

The aged also demand a dietary richer in nitrogen than adults, from their inability to assimilate so large a portion of starchy food as they did in earlier years; and hence, whilst the weight of their food may be less than that of adults, the cost of it should rather be greater than less.

Statements of certain operatives.

As a further test of the amount of food which is really necessary to the operatives, I may cite a conversation which, at my request, the Rev. Dr. Robinson, of Blackburn, had with a large class of men. They were living chiefly upon excellent food supplied by the soup kitchen, which cost the managers 3½*d.* per day for two meals, but which was supplied to the operatives gratuitously, or at a charge of 1*d.* per meal. On being asked if they could live and keep in health on two of these rations daily, they replied that they could. On further inquiry as to whether they could live on 6*d.* per day, they quickly replied, "Yes;" and when the amount was reduced to 5*d.*, they all still answered "Yes." When, finally, they were asked if they would prefer 5*d.* per day in money, or two cooked rations daily, they preferred the latter, on the pleas that they could not cook their food well, and that they could not buy so much food for that amount. Hence it appeared that 2*s.* 11*d.* per week was abundant in money, or 2*s.* 0½*d.* per week when judiciously expended and distributed as hot food.

Minimum weekly allowance for food.

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* On Cyclical Changes, *loc. cit.*

I have, therefore, arrived at the following replies in answer to the question :—

Separate cooking.

1. When food is purchased and cooked separately, the line between sufficiency and insufficiency in adults may be drawn at about 2*s.* per head weekly.

Single persons.

In the case of single persons living separately, it would incur a risk to limit the amount to 2*s.* weekly in all cases, and I am of opinion that the minimum amount to be spent weekly in food should be 2*s.* 3*d.* for women, and 2*s.* 6*d.* for men.

Man and wife.

2. In the case of man and wife without children living with them, the minimum amount should be 4*s.* 9*d.* weekly.

Man, wife, and children.

3. The case of families must be considered chiefly in relation to the age of the members, for it is manifest that a child of six years of age requires less food than a youth of 16 years of age, and in this respect the present system of averages in the supply of relief according to, and diminishing per head with, the number of members in a family, is most defective.

The minimum allowance to the husband and wife should be 4*s.* 6*d.* ; to each child over 12 years of age, 2*s.*, and to all others 1*s.* 6*d.* per week, except in the case of infants at the breast, when, if it be the only child, 1*s.* weekly should be allowed, but if there be other children no allowance will be necessary.

Food cooked in large quantities.

4. When food is prepared in large quantities and supplied at cost price, the allowance may be reduced, probably, to 2*s.* weekly for each person over 16 years of age, 1*s.* 6*d.* for each over 10 years of age, and 1*s.* 3*d.* for each under 10 years of age, excluding infants at the breast. It is also probable that the food thus supplied would be more nutritious in quality, better cooked, and eaten hotter than would occur under a system of separate cooking.

QUESTION 2.—" WHAT, WITH SPECIAL REFERENCE TO HEALTH, WOULD BE THE MOST USEFUL EXPENDITURE OF A WEEKLY MINIMUM ALLOWANCE GRANTED EXCLUSIVELY FOR THE PURCHASE OF FOOD ? "

Applies essentially to private dietaries.

The answer to this question must have its principal reference to private dietaries, for to whatever extent and in whatever mode public aid may be afforded, it cannot supply the whole of the cooked food required by the mass of unemployed operatives, and whilst the private resources of the destitute may be increased, the responsibility of selecting the greater part of the food must devolve upon the operatives themselves. Hence the distributors of relief will have to contend against the vice of some and the ignorance of others, and must select a plan which may render these evils as unimportant as possible.

Modes of administering public relief.

In the early history of the relief of the distressed operatives aid was afforded either wholly in money or wholly in food. The former was open to the objection that the husband might spend a portion of it in intoxicating liquors, and thus unfairly deprive his family of the relief afforded, and in order to prevent this, the plan was modified at Wigan, so that tickets representing a certain sum of money were given to the operatives to be exchanged at various retail shops for such articles of food as they desired. The latter had the great advantage of supplying the food at the prime cost, but it paid no attention to the varying tastes of the people, and therefore failed to afford that comfort which a supply of good food should have given.

Hence a third course was adopted, whereby relief was administered partly in money or money tickets and partly in food, and in some towns

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the latter included uncooked as well as certain cooked foods, and to this I desire to call especial attention.

Best mode.

In meeting the wants of the operatives in a manner the most consistent with health and economy, it is necessary that the three methods last mentioned be employed, viz. :—

1. A portion in money, to be expended according to the choice of the recipient.
2. A portion in uncooked foods, properly selected and charged at prime cost, and in such quantities within the prescribed limits as the operatives may prefer.
3. A portion in well-devised cooked food to be charged at prime cost, and offered with sufficient variety to meet the tastes and desires of the recipients.

Mode at Stockport.

The plan which is pursued at Stockport appears to me to meet these requirements, and to offer, perhaps, the best system of relief which is now in operation. Mr. Ed. H. Sykes, of Edgeley, has favoured me with the following statement of this plan :—

Mr. Sykes' statement.

"Stockport, as you are aware, is divided into 10 districts, and each district is supplied with money from the Central Committee to the accompanying scale, and in this district we give the relief one-third in money and two-thirds in food. For instance, a family of 4 have 8*s.* worth of relief per week to receive. They are paid 2*s.* 8*d.* in money and have 5*s.* 4*d.* to receive in food. We give them a ticket, which they can bring to the kitchen each day, and receive 10½*d.* worth of food, which they can have in bread, cooked food, meal, rice, flour, potatoes, or tea, and they can exchange any part of their money-ticket for food. The woman who has a ticket for 10½*d.* per day asks, for instance, for a 4 lb. loaf, 5½*d.* ; 3 pints of soups, 3*d.* ; and 4 lbs. of potatoes, 2*d.* ; and she may perhaps desire in addition an ounce packet of tea, 2*d.*, to be deducted from her money-ticket. Perhaps the next day the same person will have some bacon or flour instead of soup. We find on this principle that we can keep the people on 2*s.* per head per week, and they are in better health they ever were."

The cooked foods supplied by this district are rice milk, broth, Scotch broth, potato hash, and pea soup, the particulars of which will be found in the tables of public dietaries inserted at page 415, *et seq.*

Shall consider private dietaries chiefly.

As the object of this report is not to state in detail the various excellent plans by which aid is being publicly afforded to the distressed operatives, and as the public aid supplied is intended to supplement private dietaries, I shall proceed to consider the answer to the question chiefly in its reference to private dietaries.

The subject may be conveniently discussed under the following heads :—

Division of the subject.

1. Such of the general principles involved in the construction of dietary tables as may be applicable to the subject of the inquiry.
2. The economical and nutritive values of foods.
3. The actual dietaries of the operatives in ordinary times and at present, with their cost and nutritive values.
4. The composition of the cooked foods supplied by the various organizations in the towns in question, with the cost and nutritive values of each per ration.
5. The dietaries which seem to be the most fitting answer to the question, with their cost and nutritive values.

CERTAIN PRINCIPLES INVOLVED.

Principles involved in the construction of these dietaries.

The amount of fluid.—As the object to be had in view is the supply of the least quantity of food which will maintain the body in

Use of fluid.

health, it is essential that it be taken in the nearest convenient approach to the solid form, or, in other words, that too much fluid should not be taken with it. It has been abundantly proved that the admission of fluid with the food has two actions; one the due solution of the food, so that it may enter the blood, the other the removal of matters from the body. Whether the quantity which will effect the former purpose would suffice for the latter also cannot be rigidly demonstrated, since the amount of water contained in various foods differs much, and the solubility of the foods also varies; but there is great liability in dietaries for the populations now under consideration, and particularly for those of growing persons, to an excess of fluid for both of these purposes.

Evil of excess of fluid.

The evil of an excess of fluid is chiefly that of exciting vital actions unduly by removing effete matters through the kidneys and bowel too rapidly. It has been established that an excess of fluid in the dietary causes an excess of excretion by the skin, kidneys, or bowels, and more particularly by the kidneys, and the water so excreted carries with it certain elements which would not have otherwise passed out of the body so largely or so quickly. This remark applies to fluid taken with the food, when regarded through the period of a day or longer; but when fluid is taken in the morning without solid food, the effect is to cause an elimination of urine to twice or thrice of the quantity of water taken, and thus to seriously reduce the volume of the blood and the other fluids of the body. With this increase of urine there is also a corresponding increase of urea evolved, and although the origin of urea and the place of its accumulation are at present involved in mystery, it is quite certain that the urea is due to the activity of the vital processes either in the transformation of food or of tissue, and if it be thrown out in excess it must imply the waste of food or tissue. It has even been proved that the introduction of water alone in the manner referred to increases both the fullness of the pulse and the frequency of the pulsation, as shown by the following table, and consequently is fitted to increase vital action and waste.*

Action of fluid upon pulsation.

	8½ A.M.	9	10	11	12	12½ P.M.	2	3	4	5	5½	6	7¼	8	10	10½
	Water					Water					Water			Water		
Pulse		67	64	64	69		72	64	60	64		71	70		73	72

The water was taken in quantities of half a pint, and no solid food was eaten during the day.

Daily amount of fluid.

It is not easy to define the quantity of fluid which should be taken daily as a vehicle for or an adjunct to solid food, but it should scarcely exceed 2½ pints for an adult, unless there seem to be an imperative call for more.

Alvine evacuation.

The rapidity of passage of food through the bowel.—There are foods which are known to have a laxative character, such for example, as brown bread, and the result of this action must be to carry away from the body a quantity of nutritive matter. It has already been stated that under all circumstances the fæces contain nutritive elements, and other things being equal, that food which passes through the bowel the most quickly will cause the greatest waste of food. In our experiments on prisoners at the Wakefield and Coldbath Fields prisons,† with a view to accurately determine the amount

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* Philosophical Transactions, 1861, p. 826.

† Transactions of the British Association, 1861.

Quantity in prisoners and in ordinary life.

and nature of the ingesta and egesta, we found that the fæces emitted by those persons gave an average of from 7 to 10 ounces daily, and in a few instances amounted to upwards of 20 ounces, whilst the average excretion in the community is about 4 ounces daily. This was in great part due to the brown bread, and the bran in its undigested form remained in the fæces. The total waste of food daily exceeded that contained in a pint of good milk.

Effect of bran; of whole peas;

It is probable that the same remark will apply to the form of pea-soup in which whole peas are used, and the shells allowed to remain, for there can be no doubt of the fact that the shells are indigestible in that form, and that they re-appear in the fæces. This is doubtless one of the explanations of the occurrence of diarrhœa when the dietary consists largely of pea-soup, and particularly when it occurs in children.

and of nitrogenous foods.

It may also be added that the more highly nitrogenized foods, as eggs and meat, exert much less action of this nature than fresh vegetables in general.

Frequency of dejections.

It is not possible to determine rigorously how frequently the bowels should be evacuated, so as to permit full use to be made of the food, and yet to avoid the occurrence of disease. The general habits of mankind have induced a daily evacuation, and if waste of food be not of great importance, or if excess of food be taken, this is no doubt the proper course; but in hospital practice I find great numbers of persons who do not usually have an evacuation oftener than once in 4, 7, or 10 days, and, so far as can be ascertained, no evil consequences follow. This is perhaps more common in poor persons, and particularly amongst the Irish in this country, but it is not strictly limited to the poor. As it respects the class of persons now under consideration, I am of opinion that a daily evacuation is not necessary, provided only the necessary quantity and the proper kind of food be taken; and unless other circumstances exist which would modify this opinion in any particular case, it would be well if they allowed the food to remain two days.

Variety of food.

Variety of food.—It is essential that a variety of food be afforded, both at the meals of each day and on different days. In the earlier history of soup-kitchens for the factory operatives, soup was the only food supplied, and as at that time a most inadequate provision existed to meet the wants of the people, soup and bread were eaten at almost every meal, and as a consequence a nausea was created, and the soup induced diarrhœa. The ordinary habits of the people have established an appetite for difference of food supplied at the three meals of the day, at least so far that the dinner is a meal differing much from the others; and whether this be the best mode of nutrition or not, no other is possible at present. In like manner a variation from day to day, so far as refers to the dinner, would be conducive to the maintenance of the appetite and health, but this may refer only to the mode of cooking, and not to the articles of food consumed. Thus, if there be meat and potato, they will be perhaps equally nutritive, whether they are given as roasted or boiled meat and boiled potatoes, served whole, or made into potato hash, or into potato pie, or with other foods made into soup, and in each they may be equally expensive, but the digestion and assimilation of the food, and therefore the nutrition of the body, will be greater if variety of cooking be adopted. There is less necessity for any variety from day to day in reference to the other meals.

Temperature of the food.

Temperature of the food.—At this season of the year, at least, it is highly desirable that the food should be eaten when hot—as hot as can be conveniently borne, for thus a quantity of heat is given to the body, and the functions of assimilation and digestion are promoted. The first reason is a self-evident one, but the latter is rather one of medical observation. I have long observed that in cases of defective assimilation, accompanied as they usually are by feebleness of the heart's action, and of capillary vital action, the administration of hot nutritive foods quickly fills the pulse and promotes vital action, both in the stomach and the tissues. Moreover, it commonly excites the appetite, and removes any evidences of indigestion. In the class of persons under consideration, there is a large proportion of such cases, and I am of opinion that whilst the plan adopted is not injurious to any, it is particularly fitted for children and the ill-fed in general.

Principles involved in the construction of these Dietaries.

Variation of flavour of the food.

Variation of flavour.—This, like the former, is essential to a good dietary of any kind, and tends to improve the relish for and the assimilation of food. The former statement needs no proof, but the latter is supported by the fact that when the distaste for food occurs, it is accompanied by symptoms of indigestion and of deficient alimentation, although the food may still be eaten under a sense of duty or necessity. This particularly applies to made dishes, as potato hash, potato pie, soup, and gruel, and even to poor milk, when it is cooked with insipid foods. Nothing can be more easily effected than this, by the aid of the dried spices and of the various kinds of domestic dried herbs. In reference to dinners prepared at public kitchens, the variety of flavour should extend over three days in a series, since with two kinds of flavour only the appetite would the sooner seek for a change.

Existing tastes and habits of the operatives.

The existing tastes and habits.—It is necessary that no material change be attempted in reference to the fixed habits and tastes of these populations, and also that any improvements which may be advised be effected in a gradual and unobtrusive manner, for otherwise the appetites of the people will be lessened, and the food will cause disorder in the system. I have already remarked that in the ordinary habits of these populations weak infusions of tea and coffee, and a large amount of bread and other starchy foods are taken, and whilst it would not be difficult to show that variations from this dietary might be made with advantage, it would be unwise to attempt it largely in the present emergency. Hence, in any scheme of dietary full provision must be made for the supply of two meals, in one or both of which tea and coffee will often take a part, and of one meal which will not require the use of additional fluid, or, if otherwise, that tea may be again given. But to this I shall again refer.

Cooking of food;

Cooking.—It is a matter of great difficulty to provide a dietary which shall not suffer from the defective cookery commonly found amongst factory operatives. This defect arises from—

its defects,

The insufficiency of fuel and cooking utensils.

Defective knowledge; the mother and all senior members of the family go from home when at work in a large proportion of cases, so that the family or the person living alone, must depend upon others for this office, and food must be selected which may be the most conveniently cooked. Hence single women ordinarily pay a sum per week for cooking their food.

The desire for sapid and varied food which leads to a selection of food either wasteful in its cost or worthless in its effect upon the system.

Nothing is perhaps more difficult than for a single person to provide comfortable and varied food, and even in small families it is necessary to take cold dinners when economy is essential; much more will it be difficult when the single person is absent from home nearly the whole day, when the wife who should stay at home to attend to household duties works at the mill, and when the practical knowledge of cookery is the least possible quantity. It is a matter of gratulation that in many of the present arrangements for the public preparation and distribution of food a number of the factory women are for a limited period taught to cook; and no doubt the deficiency now referred to would be the best remedied by a dinner being daily provided by public kitchens to be obtained by the poor at cost price, whilst they prepare the other meals at home.

Principles involved in the construction of these Dietaries.

Proper proportion of nitrogen and carbon in foods.

Due proportion of nutritive elements.—There is a proportion required between the nitrogenous and carbonaceous elements of food taken into the system, for although chemistry has too sharply drawn the line between the heat-producing and the flesh-forming foods, physiology is now correcting the error, and showing that the two are mutually dependant upon each other. Thus in the vital changes due to the transformation of nitrogenous compounds heat is evolved, and when nitrogenous foods, as gluten, casein, and albumen, are eaten alone, the elimination of carbonic acid is increased; and it has been long proved that the fattening properties of fodder are less in relation to the carbon or *fat-forming element* than of the nitrogen or *flesh-forming element;* all of which seem to show that nitrogenous aid in the transformation of the carbonaceous compounds; and hence that a due relation must exist between these two classes of elements. The types to be referred to are bread and milk, in former of which the nitrogen is to the carbon as 1 to 22, whilst in the latter it is so high as 1 to 11. The former is the great element of dietary in adult life, the latter in infancy and childhood, and a mixture of the two in boyhood and adolescence.

in bread and milk;

The reason for the increase of the nitrogenous elements in early life has already been given, and it only remains to state that any deficiency in adult life is commonly supplied by the flesh of animals.

and flesh.

The habits of mankind differ much as to the necessity for flesh. It has been shown that neither it nor any other form of animal food is largely and generally taken by these populations, and although there is no authorized statement, there is reason to believe that our agricultural labourers and families take very little,—much less than is eaten by factory hands. Moreover, there is a certain small class of persons known as vegetarians, who do not eat flesh, and yet, so far as I am able to judge, they enjoy health and life and are as fit for the ordinary duties of life as others; but their example fails in reference to other forms of animal foods, since they partake largely of milk, eggs, and other nitrogenous compounds.

Vegetarians.

There is an impression that in adult life the nitrogen existing in bread is insufficient for the whole wants of the system, and indeed it is almost impossible in that food alone to give a sufficient supply of nitrogen, since it would require a consumption of nearly 2¼ lbs. of bread daily to give the 200 grains of nitrogen, which has already been mentioned as necessary for an adult weighing 150 lbs. But further, there can be no doubt that when bread is nearly the sole source of nitrogen a large part remains unassimilated, and passing off by the bowel is wasted; and apart from the defective health, which will sooner or later follow, a larger quantity of bread than 2¼ lbs. daily must be taken. In experiments upon myself when living upon 2¼ lbs. of bread and cold water daily alone, I found it impossible to keep up the temperature of the body, the requisite flow of spirits, and vigour; and although I changed the cold water for warm water, it was impossible to continue the experiment many days.

Bread.

Whilst, therefore, it may be yet an open question as to how far flesh is necessary as a food, it cannot be doubted that animal food in some

Various animal foods.

form, whether as milk, eggs, or flesh, must be conjoined with a farinaceous dietary.

Principles involved in the construction of these Dietaries.

Cheese.

I am in doubt as to the value which should be assigned to cheese in a dietary of the greatest practicable economy; for although it is the richest in nitrogen of any food which we possess, there is reason to doubt if a large quantity of it is digested. It has for ages been regarded as a substance fitted to promote digestion, and in my experiments, as already mentioned, its use caused the increased elimination of carbonic acid, yet it is medically regarded as a substance in itself difficult of transformation, and I have never found such an increase in the elimination of nitrogen with its use as would account for the quantity of nitrogen which it contains. Hence there is much reason to believe that a large proportion of it passes off by the bowel unused.

The waste thus occasioned, therefore, forbids us regarding cheese as valuable, in a dietary, in proportion to the nitrogen which it contains; and whilst a small portion daily is an advantage in any dietary, it cannot be regarded as a substance upon which a necessary supply of food must rest when the quantity given will not admit of waste.

Mineral constituents of food.

I do not refer to the necessary mineral constituents of foods, for they will be found in due quantity in foods supplying carbon and nitrogen, except so far as relates to common salt, which is universally taken with food.

Salt.

The use of salt must also be considered in association with that of fresh vegetables.

Its relation to potato and other fresh vegetables.

There is a widespread belief that fresh vegetables are necessary to the health of the body, and in proof the occurrence of scurvy at sea and during the recent potato famine in England and in Ireland is cited. Yet I have found large numbers of factory operatives (page 374 *et seq.*) who for many months had not taken fresh vegetables, or had taken them at very irregular periods and in very small quantities, and yet remained in health, and believed that no ill effects whatever had resulted. These persons, moreover, had previously been accustomed to take from 5 lbs. to 10 lbs. of potatoes weekly, and had discontinued them only because they had discovered that potatoes were a much dearer article of food than bread, and they had, as they said, almost forgotten the taste of potato.

Experience of the operatives.

Occurrence of scurvy.

I do not wish to give greater importance to these facts than they deserve, or to throw doubt upon the general belief as to the necessity for fresh vegetables, except as making the state of the question a ground for inquiry; but if a careful inquiry were made into the occurrences of scurvy, it might be found to have been due to other causes. Thus, when it appears on shipboard it is always associated not only with an absence of fresh vegetables but with an absence of fresh meat, whilst highly salted meat and dry biscuit are the daily staple foods. Hence this condition and that of the present state of the operatives are not parallel. Again, in the potato famine the absence of the potato was accompanied with the deepest poverty and privation of almost every kind of food, a state of things apart from the vegetables fitted to exert great influence over the blood and the nutrition of the body. This state also is not parallel with that of those who, with good fresh bread and other foods, are maintaining the body in health.

Effect of salt upon the blood.

What may be the precise effect of salted food in its relation to the use of fresh vegetables I cannot state; but it has been recently proved that an excess of salt in the blood lessens the carrying powers of that fluid for gases, and therefore must indirectly limit all vital transformation. That, therefore, an excess of salt is prejudicial to life is certain, and that so far the frequent use of salted meat is injudicious cannot be

Thirst

Necessity for acids.

doubted. Moreover, when salt has been taken in excess, thirst is induced, and when fluids are supplied they are fitted both to carry out of the system the excess of salt when they pass out, and, during their continuance in the body, to unduly increase change of tissue; and hence they will be beneficial or the contrary as the salt itself is prejudicial. Moreover, after salted food, or with salted food, there is a general desire for acids, as lemons, vinegar, or pickled vegetables. That this is beneficial cannot be doubted, but whether they have the power of removing the salt, either in its natural form or in some other form of composition, has yet to be established.

Due restriction in the use of potato; not sufficiently attended to in dietaries.

It cannot be forgotten in the construction of dietaries, that potatoes are much dearer than bread in relation to their nutritive elements (page 317), and consequently that there is good reason for restricting their use within the limits compatible with health. Yet they enter very largely into the composition of dietaries for the poor, and in gaols so large a quantity of salt as 1 oz. per head per day is allowed. I believe that for the purpose of this report both of these articles should be much limited in amount.

Necessity for fat.

Its relation to starch.

Necessity for fat.—That fat constitutes a part of the dietary of all persons and at all ages, that nature has provided it abundantly in both the animal and vegetable kingdoms, and that the flavour of it is agreeable to man, must be admitted, and would seem to prove that fat is a necessary ingredient in a dietary; yet when it is regarded in its relation to starch, and the question is proposed whether both are necessary, the subject becomes one of much difficulty. The composition of starch and fat is the same, differing only in the quantity of their elements, so that 1 part of fat will represent 2½ parts of starch, and hence there is a presumption that either or both may be used indifferently. Moreover, in practice, we find that the quantity of fat may be greatly varied in the same person without sensible effect, and that there is great diversity in the quantity which different persons take when at liberty to do as they desire. It will be seen in the dietaries, at pages 374 *et seq.*, that whilst the operatives in good times take perhaps an abundant quantity of fatty food, the quantity now taken is very greatly reduced; proving that for the purposes of nutrition the operatives forego the pleasures of the taste and act on the belief that fat may be dispensed with whilst starch must be retained. If the inquiry referred to persons taking a full quantity of food it might readily be admitted that fat is a more convenient and pleasant food than starch, and that it may be taken with a view to continue the ordinary accumulation of fat in the body, although it is now well admitted that starch and sugar may be transformed in the body into fat; but when we have to deal with persons unable to store up fat in the system, its use is less evident and the capability of supplanting it entirely by starch seems to be proved. In reference to its flavour it may be remarked that the operatives supply the lack of it by treacle, and beyond this they do not seem to feel any well-grounded want.

Action of fat as compared with that of starch.

Considering the subject, I cannot but think that the action of fat, apart from its chemical composition, is chiefly a physical one, however that action may be explained. Thus the morsel is swallowed with more readiness when it is lubricated with butter; the globules offer the material ready formed for the molecules of chyle; it gives fullness to the pulse with increase of force of the heart; when it disagrees it dries the skin, and in general I believe it to have the power of lessening elimination. In several of these particulars its action is different from that of starch, and particularly in its lubricating quality, its action upon the heart, and its anti-eliminating properties. Now as these properties are beyond and beside that of supplying nutriment, and the above actions may be in excess or defect as the starch or the fat preponderates, it is easy to see that a due but varying combination of the two is the most conducive to health.

Principles involved in the construction of these Dietaries.

Relative values of fat and starch.

Whilst therefore admitting the impossibility of determining whether the elements are the most effectual for nutrition in the form of fat or starch, and also that the relative quantity of fatty to starchy food may be greatly varied without any evil effects to the system, it is our duty to provide for a moderate supply of fat in every dietary. There is a presumption that the various kinds of fats are interchangeable, and may be varied according to the taste and pecuniary means of an individual; but admitting their relative nutritive values to be 1 to 2½, the actual market value of fatty food is far greater than that of starchy food; and the fat in the dietaries to be now recommended must be limited in amount and the cheaper forms substituted for the dearer.

Requirements of age.

The special requirements of age.—This has already been referred to, page 302, and it will suffice here to state that a more highly nitrogenized food must be supplied to the young and to the old than is required in adult and middle life. Hence, in reference to the young at least, milk becomes an essential article of dietary, since in the quantity which can be taken it offers more nitrogen than any other food. It also contains in its natural state a large proportion of fat and sugar, and hence has a composition in itself fitted for all the requirements of the system. If it could be given in sufficient quantity and quality nothing more would be really needed in early life, and the only addition which would be strictly required is that of bread or other farinaceous material as age advances. In the Tyrol it is drunk in quantities of many pints daily, and in certain districts is almost the sole food of the adult peasantry; and I shall be able to show further on that even in reference to the most economical dietary, no food offers the same nutriment at the same cost. Hence considering its great inherent value, the absolute necessity which exists for it in early life, its fitness for all ages, and the economy in its use, I think it ought to enter into dietaries wherever it can be obtained abundantly and cheaply. It moreover offers the great advantage of requiring neither skill nor time in cooking it.

Milk; its constituents; use; and economy.

Sex.

Sex.—There is reason to believe that females demand a more highly nitrogenized dietary than males, since they are by their occupation and position less exposed to the influences which of themselves promote the transformation of food, and since in married life there is at times an imperative demand made upon them for the support of their infants. Perhaps the great fondness which they exhibit for tea and coffee may seem to support this statement, since those fluids certainly possess the property of nitrogenous foods of increasing vital action. I think also that in adult life there is less necessity for fatty food, if the explanations which has been previously given of its mode of action be allowed; but in early life and the period of growth, both nitrogenous and fatty foods should be largely given. It is owing probably to the want of both of these classes of foods in sufficient quantity that the state of system is so frequently met with in girls which leads to the occurrence of consumption, and in any dietary, no matter how economical its construction, a liberal supply of nitrogenous matter must be admitted.

Distribution of food through the day

Distribution of food throughout the day.—The most economical distribution of food is that which gives it largely in the morning and at the middle part of the day, and sparingly in the evening; and indeed it may be affirmed that for the purposes of nutrition a good breakfast and a good early dinner are all that is required. This also agrees with the observations of the factory hands mentioned at page 334, where they affirmed that they could live well with two meals per day. It is also in a degree in conformity with the present habits of the large mass of persons who dine early, for the subsequent meals offer fluid rather than solid food.

Principles involved in the construction of these Dietaries.

The most satisfactory ground upon which to base this statement is, however, the state of the system and the effect of taking food in the early and late periods of the day.

State of system in the morning.

Loss of weight.

In the morning there has been a long precedent state of abstinence from food, a period of about 12 hours since the last meal, and of perhaps 18 hours since any considerable quantity of food was taken. During this period there has been a loss of weight of the body by the lungs, the skin, the kidneys, and the bowels. The loss of weight from going to bed to rising in the morning, from the respiration, perspiration, and urinary elimination alone, was in myself on the average of many months about $1\frac{3}{4}$ lbs., and when the weight of the fæces was added, the total loss was about 2 lbs. Attending this there is a sense of want and commonly there is a good desire for food.

Pulsation and respiration.

At the same period the rate of pulsation and respiration is low—lower than at other periods throughout the day-light day, and after food is taken there is a sudden increase, so that in $1\frac{1}{2}$ hours the pulsation will have risen from 70 to 100 or more, and the respiration from 13 to 16 per minute. In inquiries upon consumptive patients* I found the increase of pulsation from the breakfast to amount often to 45 pulsations per minute. The same increase was also observed in the elimination of carbonic acid, but the elimination of urea attained its maximum at a later period.

Breakfast.

These two sets of facts seem to prove that in the morning the system requires food, the food is very quickly digested and assimilated, and the vital powers of the system greatly invigorated.

Early dinner.

The effect of the breakfast, however, somewhat rapidly passes off, so that at about midday (the breakfast having been taken at 8 a.m.) the rapidity of the functions is reduced to a point only immediately above that which existed before the breakfast, and hence another meal at that period seems to be clearly indicated. After this period the functions never fall so low again until after about 10 p.m., when they gradually subside to the lowest point of the 24 hours.

Gain in weight during the day.

Summary of hourly requirements of the system.

The system finds itself empty of food in the early morning, but during the day it receives more than it loses, and thereby constantly increases in weight. At the breakfast hour the vital actions are greatly increased by food, but at the early dinner hour the effect of even a more substantial meal is less than that of breakfast, and in the evening the increase in the rate of the functions from the same food as was taken at breakfast is not a quarter of that which followed the breakfast. Hence we find as the day advances a gradual accumulation of food and a marked decrease in the effect of food, and the inference seems to be plain that in the morning the food is required and is well appropriated, whilst in the evening it is less needed, and its transformation is greatly lessened, and increased waste of it occurs. To give abundance of food early in the day so as to supply material for heat and tissue, and to supply fluid in the later part of the day so as to promote the elimination of the effete matters derived from the food and from the tissues of the body, is therefore consistent with the requirements of nature, and must be the most economical system of dietary.

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* Consumption : its early and remediable Stages. Walton and Maberley. 1862.

Economic and Nutritive Value of Foods.

Under this head I purpose to offer some observations with a view to the best selection of food for the purposes of the dietaries about to be proposed, both in reference to nutritive value and cost in the market.

Values of food.

Nutritive value.

In reference to nutritive value it must be remarked that only an approximation to the truth can be made, since, on the one hand, the analyses of foods have been confined to only a small part of the subject, and on the other, the varieties of the same kind of food as used by these populations in different places are so great that no fair sample of any of them could be submitted to analysis. Hence we must be content to take the chemical constituents of the most common varieties and of the best practical samples, and apply them to the places and foods in question, and to the populations under consideration.

Elements to be cited.

Ultimate elements.

Hydrogen and oxygen.

Carbon and nitrogen.

Free hydrogen reckoned as carbon.

As to the chemical constituents themselves, I propose to quote only the ultimate elements, and of those only the carbon and nitrogen. It would be perhaps more readily apprehended if mention were made of the fat, starch, sugar, &c., which enter into the composition of the food, but as those substances must be reduced to their ultimate elements before the true nutritive value of the food can be estimated, it would only complicate the calculations to refer to them. As to the ultimate elements, it may be remarked that it is not known in what precise state of combination the oxygen and hydrogen are found, and hence it is presumed that so far as they exist in the proper proportions they are combined as water, and do not therefore suffer decomposition in the body. When they exist in other proportions it is assumed that they have other combinations, and may be dissociated from them in the chemico-vital actions within the body, and in doing so produce heat. Hence the so-called free hydrogen is added to the carbon as a heat-generating body. I purpose under the head of each article of food to state the amount of carbon and nitrogen which it contains, and also, by the aid of Messrs. Lawes and Gilbert's tables, the quantity of both free hydrogen and carbon computed as carbon, so that from them the true nutritive values may be deduced. In reference to the dietary tables I shall cite only the carbon and nitrogen, since I wish them to correspond with the amount of determined excretions in the form of carbonic acid and urea. To include the consideration of the formation of water with the free hydrogen would be valueless, since the amount of water which is formed in the body has not been determined and cannot be used for the purposes in question; but if the aim were to show the amount of chemico-vital work which could be obtained from a given food, and to treat the subject in a purely chemical aspect, it would be necessary to consider the hydrogen as carefully as the carbon, since both generate heat.

Causes of variation in the cost of foods.

In reference to the cost of food there is much diversity, according to the part of an animal, or the reputed marketable quality of an article, and, although in a less degree, to the place where the food is purchased. As a general rule, it may be stated that when the poor buy small quantities of foods, and purchase them of very small dealers, they pay a higher price and obtain foods of an inferior quality than persons of greater pecuniary means; and this particularly applies to the present times, for whilst in ordinary periods of good income they seek articles of good quality and are content to pay the full price for them (Tables, Nos. 61 and 85), at the present they are for the most part obliged to deal with those to whom they are indebted, and to purchase articles of low value at the price demanded. When the foods are bought in large quantities they are obtained at a much less cost, and any quality may be selected. Hence, in quoting the prices of foods, I shall dis-

Appendix.

V. The Cotton Famine.

3. Economics of diet. By Dr. E. Smith.

Economic and Nutritive Value of Foods.

tinguish between wholesale and retail prices, and as the last varies much for the same quality, I shall cite certain limits of prices.

I shall now proceed to consider each of the articles which are mentioned in the lists of dietaries at page 360, *et seq.*

Bread.

Bread.

In a large proportion of instances the bread is baked at home, and particularly in the case of thrifty families, but whilst it is probable that a purer and more agreeable article is thus procured, the cost of it is not less than that purchased at the bakers, and it affords the temptation in good times of the wasteful eating of hot cakes and butter. At the present time, when bread is generally given as a part of the relief, baking at home is much less frequent.

The cost is almost universally 1½*d.* per pound, but the 4 lb. loaf may be bought for 5½*d.* or 6*d.* retail, and 5¼*d.* to 5½*d.* wholesale, according to quality.

It contains 28·5 per cent. of carbon, and 1·29 per cent. of nitrogen, and hence each lb. will contain 1,968 grains of carbon and 92 grains of nitrogen. The quantity of carbon and of hydrogen reckoned as carbon is 28·74 per cent.*

It is at the present time by far the most important source of nutriment, and there is but little reason to fear adulteration which lowers its nutritive value.

Flour.

Wheaten flour.

The retail price varies from 1½*d.* to 2*d.* per lb., but the instances in which less than 1¾*d.* per lb. is given are very few. The wholesale price for a fair quality is about 36*s.* per 240 lbs.

It contains 38 per cent. of carbon, and 1·72 per cent. of nitrogen, and consequently each lb. contains 2,656 grains of carbon and 120 grains of nitrogen. The quantity of carbon and of hydrogen reckoned as carbon is 38·3 per cent. In order to uniformity of calculation, with those families who buy bread instead of flour, I have computed the whole flour as for bread, and to do this the weight of flour must be multiplied by 1·4. Thus 14 lbs. of flour will be equal to 19·6 lbs. of bread. If the flour be of the best nutritive quality, 14 lbs. will produce 20 lbs. of bread, but this is rarely obtained.

Hence, if we take flour at 2*d.* per lb. we shall find the relative economic value of home-made and bought bread as follows :—

	s.	*d.*
14 lbs. of flour, 2*d.* - -	2	4
Yeast (German) and salt - -	0	1½
Baking - - - -	0	1½
	2	7
19·6 lbs. of bread at 1½*d.* - -	2	5

If English yeast be obtained, and the bread be baked with the ordinary domestic fire, the cost of the two will be precisely the same.

It is not sufficiently ascertained to what extent the nutritive value of flour varies with its marketable quality and price, assuming that in all cases sound wheat is used in the manufacture of the flour. It has already been shown that as brown bread hastens the matter through the bowels, and thereby wastes food, it must be a dear food, or, as has

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* Throughout these observations I have quoted the nutritive elements per lb. with special reference to the persons in question, and not precisely upon per-centage quantities.

been stated, it is the rich and not the poor man's food; but it has not been shown that the same effect follows if the bran be itself ground finely, or if the large bran only be removed.

The price of flour varies not only with the marketable quality of the wheat, but with the fineness of the dressing. In very white flour white wheat is used, which has a higher marketable value than yellow wheat, and all the coloured particles of the skin of the wheat are carefully removed by the finest sieving. But there is not at present ground for the belief that the white wheat is more nutrient than the yellow, or that flour so carefully dressed is more nutritive than one less so. My own belief is that in both of these particulars the finest high-priced white flour is a luxurious and not an economical food. It has been shown by Lawes and Gilbert, and others, that the more highly nitrogenized wheats of Southern Europe can be beneficially mixed with English wheat so as to give body to the flour, and to make more bread, but this is denied by others. Hence, for the purposes of the dietaries now to be prepared, I consider that good seconds should be the quality of flour provided.

Oatmeal.

Oatmeal.

Scotch and Derbyshire oatmeal differ somewhat in the quantity of nitrogen which they contain, and also in the former being coarsely and the latter finely ground; and, since the latter is more likely to be properly cooked, so that all the starch cells shall be opened, it is probable that in England, where the preparation of it as a food is imperfect, it is the most economical.

In both kinds a considerable quantity of the husk of the oat is found in the meal, and as it acts like the bran in flour, but in a higher degree, it tends to remove the matter from the bowel, and to induce waste. Hence in Scotland from 10 ounces to a pound is taken by a working man at a meal, a quantity greater than the system required if the whole could be applied to its nutrition. It sometimes accumulates in the small intestines, and particularly in horses eating the unground oats. The retail price varies from 1*s*. 3*d*. to 1*s*. 8*d*. the 10 lbs., or from 1½*d*. to 2*d*. per lb.; but as it is commonly sold by measure, the quantity obtained is not certain. The wholesale price is 29*s*. to 32*s*. per 240 lbs.

It contains more carbon and nitrogen than wheaten flour. The quantity of carbon is 40 per cent., or 2,768 grains per lb., and of nitrogen 2·0 per cent., or 140 grains per lb. The per-centage of carbon and of hydrogen reckoned as carbon is 41·6. As, however, the husk of oatmeal, like the bran of flour, is rich in nitrogen, and yet is not digested, we may not infer that the true nutritive value of oatmeal is so high as is indicated by its nitrogen.

Its use as a separate food is not common with the factory population, but is more frequent at Preston and Blackburn than in the neighbourhood of Manchester. It is, doubtless, best cooked by boiling it *well* in a small quantity of water, and eating it as a pudding, with fat, sugar, or milk.

Peas.

Peas.

Whole and split peas are used, and of the former white and blue are purchased separately. When the whole pea is used the skin remains separate however well it may be cooked, and when eaten is found in the same form in the fæces. Hence, as already mentioned, it acts like bran in flour and husk in oatmeal, in hastening the matter through the bowels, and thus wastes other food whilst it is not itself digestible. It is thus manifest that split peas should in all cases be preferred, and the

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Economic and Nutritive Value of Foods.

deficiency in the bulk of the food when taken into the stomach should be supplied by solid nutritive material. The retail cost is from 1½*d.* to 2*d.* a pound, and the wholesale is 44*s.* for white, and 52*s.* for blue, per 544 lbs., and at these prices is a much cheaper food than bread.

They contain 39 per cent. of carbon, or 2,688 grains per lb., and 3·65 per cent. of nitrogen, or 252 grains per lb., so that ¾ lb. of peas will supply as much carbon as 1 lb. of bread, and somewhat more than ⅓ lb. of peas, as much nitrogen as 1 lb. of bread. The per-centage of carbon and hydrogen reckoned as carbon is 39·64. If equal weights of the two foods be considered as of the same market value, the peas are nearly three times cheaper than bread in relation to the nitrogen, and about one-third cheaper in relation to the carbon. Practically, however, it is found that this relation does not hold good, for, on the one hand, the flavour of the peas prevents their daily use, whilst they tend to waste food by the bowel, and, on the other, they are not so perfectly digested as bread, and cannot, therefore, as fully, weight for weight, enter into the nutrition of the system. Hence they can never supplant bread, but as adjuncts to starchy and fatty foods are of very great value.

Rice.

Rice.

This food forms but an insignificant part of the dietary of factory populations. It is rich in carbon, but poor in nitrogen. The proportion of carbon is the same as that of peas, viz. 39 per cent., but the quantity of nitrogen is only 1 per cent., or 70 grains per lb. Hence it is inferior to wheaten flour in both respects. The quantity of carbon and of hydrogen reckoned as carbon is 39·24 per cent. The retail price varies from 1*d.* to 3*d.* per lb., the former being small and sometimes broken, the latter larger and whole. The wholesale price for the cheaper kinds varies from 11*s.* to 14*s.* per cwt.

There is much difference in flavour, as a pudding is made with equal quantities of the one or the other, but it has not yet been shown that there is a difference in their nutritive values. If we take rice at 1*d.* per lb. and wheaten flour at 1½*d.* (viz., the lowest value of each), the rice is the cheaper food. Thus,—

1 lb. of	flour	costs	1½*d.*	and contains	carbon	2,656 grs.	and	nitrogen	120 grs.
1½	rice		1½	,,	,,	4,032	,,	,,	105 ,,

Hence it requires that a greater weight of rice than of flour be eaten, and that it be accompanied by other nitrogenous food, and rice has the great advantage of being easily cooked, of being prepared in various ways, and of being composed of materials capable of perfect digestion and which do not hurry other food through the bowel. It has somewhat failed as a main element of dietary in England, because it has not been taken in proportionate quantity, and because cooked and good bread is attainable at every moment. The Asiatic eats it largely, and it is his bread. Its use might be extended in dietaries amongst the factory operatives with advantage, provided the low-priced qualities were more commonly sold, but the high price of 2*d.* or 3*d.* a lb. restricts its general use.

Sago.

Sago.

This substance is nearly pure starch, and, with arrow root, contains less nitrogen than any other natural farinaceous production. Hence its nutritive value is much less than that of the cereal grains. The quantity of carbon is 36·5 per cent., of nitrogen ·025 per cent., and in each lb. there are 2,552 grains of the former and 1·7 grains of the latter.

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Barley, Pearl and Scotch.

Scotch and pearl barley.

Pearl barley differs from Scotch barley chiefly in being more perfectly free from husk. It contains 38 per cent. of carbon and 1·3 per cent. of nitrogen, and hence is equal to wheaten flour in carbon and inferior to it in nitrogen. The quantity of carbon is 2,656 grains, and of nitrogen 91 grains in the lb.

Potatoes.

Potato.

Potato is a general, yet not universal article of food amongst factory operatives in ordinary times, but its use is now greatly restricted, and with many is entirely arrested. The retail price varies from 1*s.* to 1*s.* 2*d.* the 20 lbs., and is therefore not less than ⅝*d.* per lb. The higher-priced potatoes at the present time are believed to be cheaper than the lower, since they present a smooth and even surface, and there is much less loss in peeling them. These are called flukes and kidney potatoes. The wholesale price is from 9*s.* to 14*s.* the 252 lbs.

They contain 11 per cent. of carbon, or 760 grains per lb., and 0·35 per cent. of nitrogen, or 24 grains per lb. They possess 76 per cent. of vegetable juices, with but a small quantity, comparatively, of the two great elements of nutrition.

When compared with flour, peas, and bread, the following results are obtained :—

	lb.		*d.*		Grains of carbon.		Grains of nitrogen.
Flour	1	costs	1¾,	and contains	2,656	with	120
Peas	1·1	,,	1¾	,,	ditto	,,	254
Bread	1¼	,,	2	,,	ditto	,,	119
Potatoes	3½	,,	2¼	,,	ditto	,,	84

Hence potato is far the dearest of any of the other articles of food. As compared with flour, it requires 3½ times as much to supply the same quantity of carbon, and 5 times as much to give the same quantity of nitrogen, whilst compared with peas the factors are 3½ and 10½.

As it respects the mode of cooking it is more economical that they should be cooked in the skins, and if large cut into two; and Mr. Machaffie has ascertained that there is less loss when steamed than when boiled, the actual loss being ½ oz. steamed and 1 oz. boiled to the lb. It is very likely that potatoes roasted in their skins are cooked as economically as possible, and the method is peculiarly easy.

The loss in roasting potato (the loss being of course chiefly of fluids) varies somewhat even in the same sample, but usually it is from 11 to 15 per cent. When the potato has been very carefully removed from the skin the total loss in cooking and of the skin together is 26 per cent. The difference is not considerable with the size of the potato, but it is great when the potato is cooked too much and the skin has become thick. It was found at Preston that in peeling the raw potato the loss in weight was about one-fourth.

Turnips.

Turnips; Swedish and whites.

Swedish turnips are richer in both carbon and nitrogen than white common turnips.

Thus Swedes contain 4·5 per cent. of carbon and 0·22 per cent. of nitrogen, whilst the whites have only 3·2 per cent. and 0·18 per cent. respectively. Swedes contain 304 grains of carbon and 15·3 grains of nitrogen per lb., whilst whites have only 173 grains and 11·2 grains in the same weight. Swedish turnips contain about 5 per cent. of sugar and whites 3 per cent. The wholesale price of Swedes is 24*s.* and of whites 20*s.* per ton. The retail price is ½*d.* per lb.

Carrots.

Carrots; red and white.

Carrots contain about the same quantity of sugar as Swedish turnips. The proportion of carbon is 5·5 per cent. and of nitrogen ·2 per cent., which gives 384 grains of carbon and 14 grains of nitrogen per lb. Hence they are somewhat richer in carbon and poorer in nitrogen than Swede turnips, and much richer in both than white turnips. The wholesale price is 45*s.* per ton for red carrots, and 42*s.* per ton for white ones. The retail price is 7 lbs. to 12 lbs. for 6*d.*

Succulent Vegetables and Herbs.

Succulent vegetables.

As a whole, succulent vegetables contain about 6 per cent. of carbon and ·2 per cent. of nitrogen, and have 420 grains of carbon and 14 grains of nitrogen per lb. Hence their composition is much that of carrots and Swedish turnips. I have not found any general use made of turnip tops. I have not estimated the carbon and nitrogen contained in the herbs which are used in tables No. 89 *et seq.*, since no definite weight of them is used; but as the allowance of carbon and nitrogen in the succulent vegetables is somewhat excessive this omission is not important.

Sugar.

Sugar.

In ordinary times sugar is eaten universally by the factory populations, but at present many partially or wholly supplant it by treacle.

The retail price varies from 4*d.* to 6*d.* per lb., according as it is sold in the raw or refined state. It is probable that unrefined sugar at 4*d.* or 4½*d.* per lb. is the most economical form of using it, but of the refined loaf sugar the sweetening property is much greater in that at 6*d.* than in that at 5½*d.* per lb., and hence these populations purchase either the raw or the best refined sugar. The wholesale price is 36*s.* 6*d.* to 38*s.* per cwt. for ordinary raw sugar.

It contains 40 per cent. of carbon, or 2,768 grains of carbon in the lb., and hence has precisely the same quantity as is found in oatmeal. In nutritive or fattening value, Lawes and Gilbert have proved that it is only equal to starch, and if we take the value of oatmeal to represent starch (as both sugar and oatmeal contain the same amount of carbon), that of sugar will be three to four times as great and at the same time afford no nitrogen whatever. Hence, in point of economy, sugar in its separate form should be given very sparingly, and rather be sought for in its combined state, as in the cereal grains, milk, carrots, &c.

In my experiments sugar caused a most rapid increase in the evolution of carbonic acid, and must therefore directly or indirectly exert an important influence over nutrition; but I think it very doubtful if its value as a nutrient is in any degree proportionate to its cost.

Treacle.

Treacle.

Treacle is sold retail at 1½*d.* to 2*d.* per lb., and wholesale at 13*s.* 6*d.* per cwt. It probably contains about 32 per cent. of carbon, or 2,240 grains in the lb.

Butter.

Butter.

Butter, as eaten by the factory populations, varies in the retail price from 8*d.* to 1*s.* 2*d.* per lb., and good Canadian or good Irish butter may be purchased wholesale at 10½*d.* per lb. The high-priced kinds are presumed to be fresh butter, but it is probable that some portion of salt and water is found in it. The proportion of salt is probably ½ to 1 ounce per pound, whilst that of water may amount to 2 or 3 ounces, according as pains are taken to mix water well with it. In genuine fresh butter salt should either be absent or be in very small quantity, and water should not be purposely mixed with it. Ordinarily however, 15 per cent. of some kind of fluid is found with it.

The lower-priced butter is not more mixed with water than the higher, indeed as it is packed in large masses it is often found with a less quantity, but it is mixed largely with salt and low-priced animal fats. The salt is equivalent to the loss of an equal weight of butter, and may be estimated at 1 to 3 ounces to the pound, whilst the admixture of other fats does not materially lessen the nutritive value of the butter.

An average sample of fresh butter contains 68 per cent. of carbon, or 4,704 grains per lb.; whilst that of salt butter is 65·48 per cent., or 4,584 grains per lb. When the hydrogen is added to the carbon and reckoned as carbon the per-centage is 95·38 for fresh, and 92·65 for salt butter. It is probable that good butter costing 10*d.* or 1*s.* per lb. is the most economical kind.

If we regard butter as worth 1*s.* per lb. we shall find that it is a very dear article of food. As compared with flour, 1 lb. is equal to only 1·6 lb., if carbon be only considered, and if the carbon and hydrogen be added together, 1 lb. is equal to nearly 2·3 lbs., whilst the cost of the butter will be 1*s.*, and that of flour $2\frac{3}{4}$*d.* or $3\frac{3}{4}$*d.* omitting any reference to the nitrogen contained in the flour.

So, again, if compared with mutton fat or mutton suet, it is at least twice as dear, for mutton fat cut off from the meat may be bought at from 4*d.* to 5*d.* per lb., and mutton suet at 6*d.* per lb., and neither of them contains so much salt or water. Hence it is only its flavour and the consistence whereby it may easily be spread upon bread, which can defend its use in an economical dietary.

Lard and Dripping.

Lard and dripping.

The market value of these substances varies from 6*d.* to 9*d.* per lb. With the cheaper qualities of lard we find salt and yet cheaper fats, whilst the value of dripping depends rather upon its cleanness, the mode of cooking, and the kind of meat whence it is derived; so that beef dripping and dripping from meat roasted at an open fire are preferred.

They contain (or should contain) 10 per cent. less water or other fluids than suet or butter, and are richer in carbon by from 5 to 10 per cent. The quantity of carbon is 76 per cent., or 5,320 grains in the pound, but when the hydrogen (reckoned as carbon) is added the total quantity is 107 per cent.; hence they are cheaper foods than butter. When the lard is sold at a price below 8*d.* per lb., I have assumed that it is mixed with salt, and have deducted 3 per cent. from the contained quantity of carbon. Good dripping can be purchased at 5*d.* to 6*d.* per lb.

Bacon.

Bacon.

Bacon is a common article of diet amongst factory hands; one quite as common as fresh meat. It is eaten even at the present time, but of an inferior marketable quality.

The retail price varies from 4*d.* to 8*d.* per lb., and the wholesale at $3\frac{1}{2}$*d.* for old, and $4\frac{1}{2}$*d.* for new American.

In ordinary times the price almost universally given is 7*d.* or 8*d.*, whilst at present from 4*d.* to 6*d.* is the ordinary cost. The low-priced bacon is chiefly American, and whatever its source it is wet, as if recently brought out of pickle, and as the chemical constituents of fresh and dry bacon vary, I have calculated all bacon below 6*d.* per lb. as if it were fresh. The chemical constituents moreover vary in the same kind, as the fat or the lean preponderates, and as these two portions differ according to the part of the flitch selected, it is impossible to ascertain the precise elements except by an analysis of any particular portion. Hence I can only take analyses which have been made from a fair admixture of the two.

Green bacon contains 61 per cent. of carbon, or 4,265 grains per lb., with 1·13 grains of nitrogen, or $78\frac{1}{2}$ grains per lb.

Dried bacon contains 68 per cent. of carbon, or 4,753 grains per lb., and 1·4 grains of nitrogen, or 96 grains per lb. There is at least 5 per cent. less water contained in the dried than in the green bacon.

There is not therefore any great difference in the nutritive value of different qualities of bacon, and at 4*d.* per lb. it is by far the cheapest source whence fat may be obtained. For the purpose of these dietaries the price ought never to exceed 6*d.* per lb., and there is no good reason why it should exceed 5*d.* When it is fried it should be with food which will absorb the liquid fat, or be cooked in a small pan from which it may be eaten, and if this be effected not more than 10 to 15 per cent. of its weight will be lost. When it is boiled the liquor obtains some of the fat and flavour of the bacon, and is useful as a vehicle for the cooking of peas, cabbage, or other vegetables; and hence with care no portion whatever of the bacon need be lost. If the aim be to supply fat, the back of the pig should be selected; but if to supply nitrogen as well as fat and flavour, the shoulder or the ham is the most suitable; and for the purposes of soup the shoulder is to be preferred.

Meat.

Meat.

I am informed by Dr. Angus Smith, F.R.S., that a serious and probably successful attempt is now being made from Glasgow to import the meat of the two millions of beasts which are annually slaughtered for their fat in South America, at a cost not exceeding 2*d.* to 2½*d.* per lb. If this should succeed, it will add greatly to the resources of the working population of these islands.

At present the retail price varies in the districts in question from 5*d.* to 8*d.* per lb., according to the part of the animal selected. When bought in large quantities, the price varies from 5*d.* to 6*d.* per lb., and the parts purchased belong to the fore quarter of the ox, as the top ribs, flat ribs, long brisket, thick brisket, vein and spaud, as shown in the accompanying diagram. When the legs and shins are purchased largely, the price is about 3½*d.* per lb. At Preston they pay only 3½*d.* per lb. for a quarter or half a cow, and 4½*d.* per lb. for a sheep or half a sheep. The higher-priced pieces are the sirloin, ribs, round, and rump, and an intermediate one is the thick flank.

It is not possible to form an average of the parts selected by the operatives in ordinary times, and when they pay the full price, but when it is bought in quantities of several pounds it is probably taken from the back. At the present period, when the quantity bought at a time is small and the price which is given is low, it is probably pieces which have been left in cutting up the joints and the parts of so-called inferior quality.

It has been usual to consider that an average sample of meat contains 30 per cent. of carbon and 2 per cent. of nitrogen, but Messrs. Lawes and Gilbert have more recently shown that this is too low, and that as sheep are commonly fatter than oxen, we must distinguish between beef and mutton. They assert that beef of such quality as the operatives obtain contains 34·3 per cent. of carbon and 2·5 per cent. of nitrogen; whilst mutton supplies 41·45 per cent. of carbon and 2 per cent. of nitrogen. As the populations referred to eat both beef and mutton, but probably beef more than mutton, I purpose to take a mean, consisting of two-thirds of beef and one-third of mutton, and to consider that meat contains 37 per cent. of carbon and 2·3 per cent. of nitrogen. This will give per lb. 2,580 grains of carbon and 160 grains of nitrogen. When the hydrogen is added to the carbon, and both reckoned as carbon, the per-centage is 45·02 in beef and 55·88 in mutton. Mutton contains more solid matter and carbon, but less nitrogen than beef.

I do not purpose to refer to the effect upon the meat of modes of cooking, but one fact of great interest which was ascertained by our analyses may be mentioned, viz.,—the great defect of salts in boiled meat. The quantity of salts found in the liquor of boiled fat beef evaporated to dryness was no less than 29·13 per cent., and as the salts are of great value, the importance of eating the meat and the liquor together is very evident.

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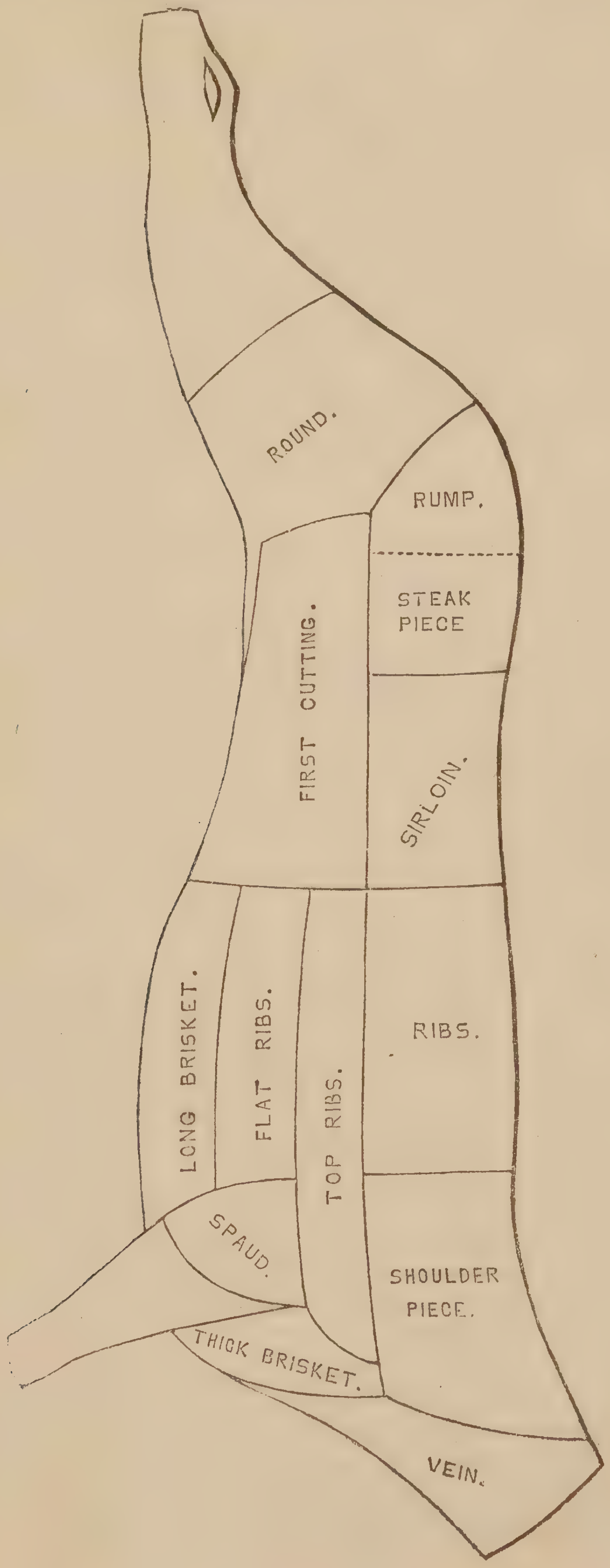
FOOD. VALUE OF

Salts removed by boiling.

Meat. Joints of an ox.

DESIGNATION of the parts into which the side of an ox is divided.



Proportion of bone in meat.

In reference to bone, Mr. Machaffie found it to amount to 15 per cent. of the joint in the parts indicated at page 320. At Preston there were 1,020 lbs. in 10,776 lbs., or about 10½ per cent.; at Blackburn, 8 lbs. in 64 lbs., 13 lbs. in 144 lbs., and 17 lbs. in 124 lbs., or an average of 9 per cent. At the Shakspeare Mill the proportion was 15 lbs. in 42 lbs., or about 30 per cent., but the meat used there was shins. At Stockport the bone was 6 lbs. in 112 lbs., and 12 lbs. in 112 lbs., but in both instances the bones were weighed after boiling, and hence would have lost weight. At the Lancashire Hill soup kitchen the bone was about one-third of the gross weight. At others 6 lbs. in 40 lbs., 3 lbs. in 25 lbs., 2 lbs. in 20 lbs., and 1½ lb. in 20 lbs. Thus the average weight of bone in the legs and shins may be taken at one-third, and in other inferior parts at one-tenth to one-seventh.

Mr. Machaffie found, at my request, that an ox head, weighing 18 lbs., gave 8½ lbs. of meat, and the bone was thus more than 50 per cent.

These quantities refer to beef, and if well-fed oxen be selected, the proportion of bone will not be less in other animals.

Allowance for bone and

When calculating the nutritive value of the meat in the dietaries recorded on page 374 *et seq.*, I have deducted 10 per cent. for bone in the case of families, but have not deducted anything in the case of separate individuals; for whilst the former would buy meat in a larger quantity at one time, it would probably contain bone, but in the latter the small piece could be easily selected without bone, and probably in the majority of cases was so.

fat.

The question of fat applies much more to mutton and pork than to beef, and important as it may be in this investigation, we cannot approach nearer than the fair samples referred to in the analyses.

Relative value of different joints.

Chemistry has not shown any very material difference in the nutritive values of the flesh of different animals or in the various parts of the same animal, assuming that in all cases lean flesh be alone taken for the analysis. But practically a difference is believed to occur. Thus it is of common belief that beef is "stronger" food than other flesh, and of the parts of animals the best joints as they are called, the sirloin and ribs of beef, and the leg of mutton, are the most profitable joints. That there is a difference in the flavour, and in the quantity which a moderate person eats, is certain, so that the parts offering the greatest amount of flavour are accounted the best joints, and the person would eat less in weight of those at a meal. Thus the quantity of leg of mutton which such a one would eat is less than that of the shoulder or the neck, and the quantity of the sirloin is less than that of the flat ribs or other inferior part. In this statement I do not include what a person could eat who was ravenously hungry or who was accustomed to ill-fed meat or to poor joints, but that which a well-fed and moderate person finds to be his daily experience. Hence, it is probable that the osmazome, or the flavour of meat, may bear an importance similar to that of the aromas of wine, although this may not be shown by the chemical composition of the joint. Or it may be that the inferior parts being commonly of looser texture and containing more fat, a larger quantity is required to meet the wants of the system than would be case with the fleshy back —loin, rump, or round.

In an economical point of view it is very probable that the round and the thick flank are the best, since they are almost entirely without bone, and next to these the "best joints," as the leg of mutton, and loin or ribs of beef, when they can be obtained at a fair price. When the desire is to boil the beef and use the liquid, the parts mentioned at page 352 are probably the cheapest.

Salted meat should be excluded from the dietaries of the poor, because the nutritive value of the food is lessened, as Liebig has shown, because the fibre is less digestible, and because an excess of salt in the system is injurious.

Nutritive value of bones.

The nutritive value of bones in dietaries is much under-estimated. In Mr. Machaffie's experiment on the bone and meat of the ox-head it was found that 9½ lbs. of bone lost 2 lbs. in cooking, and thereby gave that weight of nutritive material to the food. This will vary with the kind of bone, for the long bones being very dense will yield only the marrow from the shaft and the nutritive material from the cellular structure of the ends, whilst rib bones, vertebræ, &c., would yield a larger amount. On careful experiment I find that shin and leg bones suitably sawn into small pieces, but retaining any marrow which may be found in them, lose 10 per cent. in weight after boiling in an open vessel 7 hours, and 19 per cent. after boiling 9 hours. Cancellated bones, as the vertebræ, ribs, and flat bones, similarly broken up, lose 16 per cent. after boiling 7 hours, and 24 per cent. after boiling 9 hours. All kind of bones are sold by the butchers in London in large quantities at 9*d.* or 10*d.* the 8 lbs., but in the towns where the factory populations live, the price is 1½*d.* or 2*d.* per lb. and the supply is not large. After they have been broken up and well boiled they are worth ½*d.* per lb., so that the loss upon them will not exceed 1*d.* per lb.

I have had special analyses made to show the true nutritive value of bone liquor. Five lbs. of shin bones were boiled for 9 hours, and the resulting liquor yielded 817·6 grains of carbon, and 28·47 grains of nitrogen for each pound of bone before boiling. The cancellated bones treated in the same manner yielded 748·12 grains of carbon, and 20·1 grains of nitrogen for each pound. When bones of a mixed character are used (as is commonly the case), we may regard the nutritive value in carbon and nitrogen as 783 grains and 24 grains per lb. If the free hydrogen be added to the carbon, and the whole reckoned as carbon, the heat-producing value will be much greater, as has been already shown when treating of the value of fat in food.

No exception can be taken to the value of the carbon in bone liquor (derived as it is chiefly from fat), but some may object to the value of the nitrogen on the ground that it would be derived from gelatin, and the "Gelatin Commission" expressed doubts as to the true value of gelatin as an article of food. To this I would reply that the nitrogen is probably in great part derived from albuminous compounds, and I am of opinion that as gelatin was in my experiments converted into urea, it must act as a true food.

In the preparation of soup nothing is probably more important than the nutritive material from a sufficient quantity of bones, and this may be added without any material addition to the cost. This is applicable to families as well as to soup kitchens, and perhaps in a less degree to separate persons.

Liver.

Liver.

It is probable that the value of the liver, &c., constituting the "pluck" of animals, is under-estimated. Liver is sold at 3*d.* to 4*d.* per lb., and a whole sheep's pluck is sold at Wigan at 2¼*d.* per lb.

Cows' liver contains 17·52 per cent. of carbon and 3 per cent. of nitrogen, and therefore there will be in each lb. 1,226 grains of the former and 210 grains of the latter. Care should be taken to ascertain that the liver is not diseased, and also that it is well cooked.

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VALUE OF FOOD.

Herrings.

Herrings.

Fresh and salt herrings differ much in chemical composition on account of the dryness of the latter, but it is probable that the former is the best food. Fresh herrings contain 12 per cent. of carbon (or 14·3 per cent. with the hydrogen reckoned as carbon added), and 1·83 per cent. of nitrogen, whilst dried herrings contain 20·5 per cent. of carbon and 3·11 per cent. of nitrogen. 1 lb. of fresh herrings, therefore, contains 840 grains, and 1 lb. of dried herrings 1,435 grains of carbon, whilst the contained nitrogen is 128 grains and 217½ grains. Fresh herrings contain about 70 per cent. of fluid. A small one weighing 3 ounces when dried is sold for ½*d.*, and such a one will contain 269 grains of carbon and 41 grains of nitrogen, but whether the whole of this will be appropriated to the nutrition of the system will depend on its degree of saltness and upon the digestive powers.

Milk.

Milk.

Milk is used by the factory populations in three forms, viz. new milk, skimmed milk, and butter milk. The price of the two latter is guided by that of new milk, so that skimmed milk is one-half the price of new milk, and butter milk one-half the price of skimmed milk. The price of new milk varies in the different towns from 1½*d.* to 1*d.* per pint. At Manchester, Ashton, Wigan, and Preston it is 1½*d.* and 1¼*d.*, whilst at Stockport and Blackburn it is 1*d.* to 1¼*d.* Butter milk is sold at Blackburn at ¼*d.* per pint. The supply of skimmed milk and butter milk does not appear to be large at any time, and the least so in the winter season, but it is probable that a larger demand would in due time induce a larger supply. New milk in particular is liable to lose a part of its nutritive value by the addition of water. If no adulterating material be added, its specific gravity should be 1,031. There is, however, some variation as the butter or the cheese predominates in the milk, for it is well known that certain cows and certain foods yield more butter, and others more cheese in a given quantity of milk. The aim of town dairies is to supply that kind of milk which will afford the largest amount of cream, and the cow and food are provided accordingly.

Variation with season

and with period of the day.

It is also to be borne in mind that the quality of milk varies with the season, and is generally richer in all solid matters in the spring and summer than in the winter, unless the solid and fluid food be carefully regulated at all seasons. That a cow will give more milk in the morning if she be allowed to drink water freely and to eat "grains" an hour and a half or two hours before, has long been known, but it has only of late years been proved that milk is 3 per cent. richer in solid contents at the evening than at the morning milking. This is due doubtless to the same cause as those already referred to in the accumulation of food, the elimination of urea, and the necessity for an abundant supply of fluid in the afternoon.

Professor Boedecker, following in the steps of Dr. Hassall, found as follows :—

New Milk.

——	Morning.	Noon.	Evening.
Solids - -	10 per cent.	- - -	13 per cent.
Butter - -	2·17 ,,	2·63 per cent.	3·42 ,,
Cheese - -	2·24 ,,	- - -	2·70 ,,

New milk yields 6·24 per cent. of carbon, or 546 grains per pint, and 0·5 per cent. of nitrogen, or 43 grains per pint. The carbon is found

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chiefly in the fat and sugar of milk, and as skimmed milk differs from new milk only in the absence of fat, the only loss is that of carbon, so that skimmed milk contains 5 per cent. or 438 grains of carbon per pint. Butter milk differs from skimmed milk only in an increase in the quantity of acid and a diminution in the quantity of sugar. It contains 4·79 per cent. of carbon, or 420 grains per pint, and 0·5 per cent. of nitrogen, or 43 grains per pint.

Relative economy of new milk, skimmed milk, and butter milk.

Hence it is evident that economically skimmed milk and butter milk are better foods in our dietaries than new milk, since the fat in which they differ from new milk can be added to them at a less cost than the difference between their value and that of new milk. Thus, if new milk cost $1\frac{1}{2}$*d.* per pint and skimmed milk $\frac{3}{4}$*d.*, half an ounce of mutton fat may be added at a cost of $\frac{3}{16}$ of a penny, and thus $\frac{5}{16}$ of a penny be saved upon the pint, or in other words, about $1\frac{1}{2}$ pints of milk equal to new milk may be provided for the cost of 1 pint of new milk. So in like manner, if butter milk be thickened with flour, and fat and spice added, it is rendered nearly equal in nutritive value to new milk. It is necessary in dissolving the fat to cut it into very small portions, and suspend them in a fine muslin bag in the milk whilst it is being warmed over the fire, so that it may be thoroughly dissolved and escape into the milk in small particles.

Cheese.

Cheese.

Cheese differs much in value according as it contains fat and flavour, or has undergone secondary changes. Its price varies from 4*d.* to 8*d.* per lb. in the districts in question, but the ordinary price is 6*d.* per lb. Good American cheese is bought wholesale at 42*s.* per cwt.

It is impossible to give a correct estimate of the nutritive value of cheese without knowing whether the piece in question is made from skimmed or new milk, but an average sample of cheese worth from 6*d.* to 7*d.* per lb. contains 38 per cent. of carbon, or 2,657 grains per lb., and 4·5 per cent. of nitrogen, or 316 grains per lb.

Mention has already been made as to the supposed indigestibility of this food, and it may be added that new cheese, very old cheese, which has undergone secondary changes, and skimmed milk cheese are probably the least easily digestible. A cheese of fair quality, and about one year old, is probably the most economical and nutritive. But in no case I believe should more than $\frac{1}{2}$ to 1 oz. be taken at once, and even that should be masticated very carefully. It is most fitly taken with other foods.

Tea and Coffee.

Tea and coffee.

Tea and coffee cannot be regarded as nutrients in the sense of supplying nutritive material, but only by their property of exciting the vital actions, and thereby, under fitting circumstances, the transformation of other foods. Both act powerfully and quickly in increasing the respiratory or heat-producing function, and both in a certain degree retard the elimination of urea, or the product of tissue and flesh-forming food change, by the kidneys. Very numerous experiments made upon myself and others in ordinary life, and also upon prisoners in Coldbath Fields prison, prove these facts, and in reference to the elimination of urea the results are supported by other observers. However, as they are always drunk with much hot water, they supply the fluid which the body requires at fitting times and in a fitting form, and so far conduce both to the right use of food, and the removal of excretory matters. Moreover they possess the negative advantage of causing the avoidance of so great a use of alcoholic liquors as would

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otherwise doubtless take place. Hence the use of these substances, apart from the water which is taken with them, depends upon the presence of a sufficient amount of food in the system, and of a deficiency in the assimilation of food. If whilst the appetite, digestion, and assimilation are good, and whilst there is a deficiency of food, tea and coffee be taken, they must be so far injurious ; but when the system is full of food, as after a dinner, or when sufficient food is being taken, or when the assimilation is defective and the food is at the same time abundant, they are most beneficial.

The populations under consideration use tea and coffee somewhat largely in their heated factories in ordinary times, and as it is probable that the assimilation is seldom perfect, and there is an abundance of the non-nitrogenous foods, this is done with advantage. They are taken even now, but generally in less quantities, and still they are accompanied with much starchy food, but under present circumstances they are less needed, and could be most advantageously supplanted wholly or partially by milk.

Different action of tea and coffee.

The essential difference in the action of tea and coffee, is that tea tends to increase, and coffee to decrease the action of the skin, so that a skin, soft and tending to perspire, for the most part, occurs with the use of tea, whilst with coffee the skin commonly remains or becomes dry. Hence they are fitted for different states of the system, and generally coffee should be preferred in the morning.

It is, however, to be noticed that the quantity of solid tea and coffee taken at a meal by these populations is very small, and that the effect can scarcely be other than that due to the warm water, sugar, and milk.

Relation of weight to bulk of tea.

There is reason to believe that a good genuine congou at 2*s.* 10*d.* to 3*s.* wholesale, and 3*s.* 4*d.* retail per lb., is equal in real value to higher-priced black teas, for they contain as much theine, and are inferior only in the volatile oils which give flavour. Genuine green teas are more closely rolled than the black, and are heavier for the same bulk, and hence, if the quantity used be measured by bulk and not by weight, there will be a much larger quantity of tea used with the green than with the black. The following are the respective weights to bulk of different kinds of tea, given by me in a paper read before the Society of Arts, and published in their Journal of 15th Feb. 1861 :—

Black Teas.

——	Grains.	Spoonfulls per lb.
Oolong - - - - -	39	179
Large leaf Congou - - -	52	138
Flowery Pekoe - - - -	62	113
Souchong - - - -	70	100
Fine Congou - - - -	87	80

Green Teas.

Hyson Skin } large leaf - - -	{ 58	120
Twankay }	{ 70	100
Hyson - - - - -	66	106
Fine Imperial - - - -	90	77
Scented Caper - - - -	103	68
Fine Gunpowder - - - -	123	57

It is, perhaps, scarcely worth the trouble, for the purpose of dietaries, to determine how much nitrogen is supplied by tea and coffee.

Tea contains 2 per cent. of theine, and about 20 per cent. of gluten, but boiling water will take up only about 16 per cent. of all the components of the leaf together. If, therefore, we allow that the whole of theine and one-fourth of the gluten are dissolved, the quantity of nitrogen which will be obtained from each ounce of tea will be less than 10 grains per ounce, and that of coffee 5 grains per ounce. It is quite evident that the action of tea is not wholly due to its nitrogen.

Chicory.

Chicory.

This substance is also a vital excitant, but much inferior to coffee. Its low price (4*d.* to 6*d.* per lb.) enables the dealers to sell so-called coffee at 1*s.* per lb., and the proportion in which it is mixed with chicory is not commonly stated. It is better to buy the chicory apart from the coffee, and to add one part in four. Chicory contains about 36 per cent. of carbon and 1·5 per cent. of nitrogen, but the quantity taken up in an infusion has not yet been determined.

Beer or Porter.

Beer.

Beer or porter of average strength contains about 4·5 per cent. of carbon, and 0·01 per cent. of nitrogen. I do not, however, purpose to refer further to them, since the practical experience of hundreds of thousands now out of employment proves that they are not necessary to the system, and, apart from other considerations, they are dear foods.

Eggs (exclusive of shell).

Eggs.

Eggs contain about 11 per cent. of fat, 75 per cent. of water, 1·4 per cent. of salts, $15\frac{1}{4}$ per cent. of carbon, and 2 per cent. of nitrogen, so that the quantity of carbon and nitrogen contained in each ounce is $66\frac{3}{4}$ grains of the former and $8\frac{3}{4}$ grains of the latter; and as the weight of low-priced, viz., small eggs, is about $1\frac{3}{4}$ ounces, the total carbon will be 166 grains, and nitrogen $15\frac{1}{3}$ grains, in each egg.

PRIVATE DIETARIES IN ORDINARY TIMES AND AT PRESENT.

Private dietaries of the factory populations.

The following series of tables contain the exact quantities of food, with its cost and nutritive value, of a large number of persons in periods of abundance and at the present time. The details have been sought with the greatest minuteness and care, and are I believe worthy of full credit. The classes of persons included are chiefly single persons living separately, and persons with large families, the latter being subdivided into those chiefly composed of young, and others chiefly composed of grown-up children. They are so far selected as to be for the most part persons of fairly thrifty habits, and a few have been selected to show upon how small an income a large family may live, and yet maintain a fair amount of health. Moreover, when it was practicable, the dietaries at the two periods have been taken from the same person or the same family, so that a careful examination might show the view entertained by them as to luxuries and necessaries. The quantity and cost of beer and other alcoholic liquors were not inquired into, as it was feared that correct answers might not be given. I have thought it best to give especial attention to the cases of persons living separately, since I was thus able to determine accurately the amount of food necessary to the wants of an adult person. The case of families is more complex and less satisfactory, since with the diversities of age of the members of the family, and their consequent diversity of requirement of food, the estimation per head has but little scientific value.

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The following Table, No. 3, contains an analysis of the returns of 36 single perso
matters

TABLE No. 3. - - - - -

WEEKLY.	MALES.				FEMALES.							
	6 PERSONS NOW.				11 PERSONS ORDINARILY.				19 PERSONS NOW.			
	Persons.		Limits of Quantity of Food.	Average Quantity of Food.	Persons.		Limits of Quantity of Food.	Average Quantity of Food.	Persons.		Limits of Quantity of Food.	Average Quantity
	No.	Per Cent.			No.	Per Cent.			No.	Per Cent.		
Bread - lbs.	6	100	8 to 12	10¾	11	100	8 to 16½	12·1	19	100	8 to 14	8·8
Oatmeal - ,,	3	50	1 to 2½	·83	7	63	1 to 4	1·1	8	42	1¼ to 3	·8
Peas - ,,	—	—	—	—	—	—	—	—	—	—	—	—
Rice - ,,	- -	- -	- -	- -	2	18	½	- -	1	5	½	-
Potato - ,,	1	16	5	·83	8	72	5 to 10	5·	7	37	¾ to 10	1·6
Onions - ,,	1	16	2	·33	2	18	½ to 2	·2	1	·5	2	-
Turnips - ,,	—	—	—	—	—	—	—	—	—	—	—	—
Sugar - ,,	3	50	½ to 1	·33	11	100	½ to 1½	·9	15	80	¼ to 1	·4
Treacle - ,,	4	66	1 to 2	·83	4	36	½ to 1	·31	9	47	½ to 1½	·5
Butter - ,,	4	66	¼	·16	11	100	½ to 1½	·7	12	63	⅛ to ½	·2
Lard - ,,	- -	- -	- -	- -	2	18	⅛ to ¼	- -	2	10	1/16 to ⅛	-
Dripping - ,,	- -	- -	- -	- -	- -	- -	- -	- -	2	10	¼	-
Suet - ,,	- -	- -	- -	- -	1	·9	¼	- -	- -	- -	- -	-
Bacon - ,,	4	66	½ to 1	·61	9	81	¼ to 1	·43	12	63	⅛ to ½	·2
Meat - ,,	- -	- -	- -	- -	7	63	½ to 2	1·	2	10	¼ to 1	-
Herrings - No.	4	66	2 to 21	5·	5	45	1 to 3	1·1	6	31	1 to 7	1·
Milk, new, pints	- -	- -	- -	- -	6	54	⅔ to 3	·93	3	16	⅓ to 2	·1
,, skimmed ,,	3	50	1½ to 3½	1·1	1	·9	1	- -	3	16	½ to 3	·3
Butter milk ,,	- -	- -	- -	- -	- -	- -	- -	- -	2	10	1 to 6	·4
Cheese - lbs.	3	50	⅛ to 1	·2	5	45	⅛ to ½	·18	1	5	½	-
Tea - - oz.	3	50	½	·25	11	100	½ to 2	1·45	14	73	½ to 2	·8
Coffee - ,,	6	100	1 to 2	1·8	8	72	¼ to 2	1·1	10	52	1 to 2	·8
Chicory - -	—	—	—	—	—	—	—	—	—	—	—	—
Total weekly	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	-
Total daily -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	-

s to their weekly dietary in former or in present times, or in both, and exhibits some nterest.

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SINGLE PERSONS.

WEEKLY.		NUTRITIVE VALUES.					
		NOW.				ORDINARILY.	
		MALES.		FEMALES.		FEMALES.	
		Carbon.	Nitrogen.	Carbon.	Nitrogen.	Carbon.	Nitrogen.
		Grains.	Grains.	Grains.	Grains.	Grains.	Grains.
Bread - -	lbs.	21,156	989	17,218	809	23,813	1,113
Oatmeal - -	,,	2,307	116	2,343	119	3,045	154
Peas - -	,,	—	—	—	—	—	—
Rice - -	,,	- -	- -	70	2	244	6
Potato - -	,,	630	20	1,216	38	3,800	120
Onions - -	,,	140	7	42	2	84	4
Turnips - -	,,	—	—	—	—	—	—
Sugar - -	,,	923	- -	1,246	- -	2,491	—
Treacle - -	,,	1,859	- -	1,120	- -	694	—
Butter - -	,,	752	- -	940	- -	3,293	—
Lard - -	,,	- -	- -	52	- -	181	—
Dripping -	,,	- -	- -	140	—	—	—
Suet - -	,,	- -	- -	- -	- -	107	—
Bacon - -	,,	2,900	58	1,045	21	2,043	41
Meat - -	,,	- -	- -	170	10	2,580	160
Herrings -	No.	1,342	204	269	41	290	45
Milk, new, -	pints	- -	- -	71	6	507	40
,, skimmed -	,,	482	47	126	13	40	4
Butter milk -	,,	- -	- -	168	17	—	—
Cheese - -	lbs.	531	63	70	8	478	57
Tea - -	oz.	—	—	—	—	—	—
Coffee - -	,,	—	—	—	—	—	—
Chicory - -	-	—	—	—	—	—	—
Total weekly -	-	32,122	1,504	26,306	1,086	43,690	1,744
Total daily -	-	4,588	215	3,758	155	6,241	249

Comparison of ordinary and present dietaries.

Thus at the present as compared with former times there is much less of nearly every kind of food eaten, but particularly of potato, sugar, butter, meat, and milk, with a considerable diminution also of bacon and tea. Bread is now the principal food, and the average consumption of it weekly is nearly 11 lbs. by the men and 9 lbs. by the women, with the addition of a little more than $\frac{3}{4}$ lb. of oatmeal. The quantity of potato eaten by the women is only about $1\frac{1}{2}$ lb. per head weekly, and by the men about half that amount. Meat in the smallest quantity is only obtained by 10 per cent. of the women, and only about $\frac{1}{4}$ lb. of bacon and butter with $\frac{1}{2}$ lb. of sugar are eaten per head weekly. Milk and cheese are scarcely noticed, but an average of more than $\frac{3}{4}$ oz. each of tea and coffee is procured.

Average consumption of carbon and nitrogen.

The average quantity of carbon now consumed by the men daily is about 4,588 grains, and by the women about 3,758 grains, whilst that of nitrogen is 215 grains and 155 grains respectively, the proportion of nitrogen to carbon being about 1 to 21 in the men, and 1 to 23 in the women. Hence the women take a much smaller quantity of food than the men, and particularly of the nitrogenous kind.

Selected instances.

The difference in the amount consumed formerly and now is shown in reference to the women in Table No. 4. In ordinary times they obtained a much larger amount of food than at present, the former quantity being on the average no less than upwards of 6,000 grains of carbon and 250 grains of nitrogen. The chemical constituents in the present dietary are not more than were found in the bread alone of the ordinary one. A striking instance of the difference in the two dietaries is furnished by a single woman, No. 17. In ordinary times she consumed 6,179 grains of carbon and 233 grains of nitrogen, whilst at present she remains in good health taking only 2,783 grains of carbon and 108 grains of nitrogen. As an instance of great excess in food, I cite the case of another female aged 20, No. 12, who ate about 8,550 grains of carbon and 373 grains of nitrogen daily ; she now consumes about 4,826 grains of carbon and 188 grains of nitrogen daily. There are, moreover, 4 other women who in ordinary times consumed more than 7,000 grains of carbon, and, in the whole, 13 persons ate more than 5,000 grains daily, a quantity which must be regarded in the case of women as excessive. On the other hand, 4 women do not obtain so much as 3,000 grains of carbon, and one is subsisting upon less than 100 grains of nitrogen daily. The extremes are 8,465 grains and 2,742 grains of carbon, with 373 grains and 99 grains of nitrogen, and yet in each instance the person remained in a fair state of health ; a fact which proves how much diversity exists in the habits of persons very similarly situated, and how tolerant the system is of excess of food. The best arranged dietary is that of No. 21, living on 2*s.* $0\frac{3}{4}$*d.* per week.

Arrangement of the tables of dietary.

The following tables are arranged in three series :—

1. Separate persons, males and females, in each of the towns separately.
2. Married persons without children.
3. Married persons with children, arranged in the order of the number of children living at home with their parents.

Summary of nutritive elements in the food of single persons.

TABLE NO 4.

SINGLE PERSONS.

Showing the Amount of Carbon and Nitrogen consumed per head daily.

Sex.	No.	Carbon.	Nitrogen.	Remarks.
		Grains.	Grains.	
Males - -	*5	- - -	- - -	Now.
„ - -	6	4,358	285	„
„ - -	7	4,787	133	„
„ - -	8	5,370	236	„
„ - -	9	4,528	165	„
Females -	10	5,183	206	Now and ordinarily.
„ -	11	5,169	230	Now.
„ † -	12	8,554	373	Ordinarily. Exceedingly large.
	13	4,826	188	Now.
„ -	14			
„ -	15	5,822	218	Ordinarily.
	16	5,643	253	Now.
„ -	17	6,179	233	Ordinarily. Very full.
„ -	18	2,783	108	Now. Very low.
„ -	19	7,475	299	Ordinarily. Very full.
„ -	20	3,801	165	Now.
„ -	21	3,777	165	Now. The best arranged.
„ -	22	3,011	109	Now. Very low.
„ -	23	5,171	222	Ordinarily.
	24	5,008	156	Now.
„ -	25	2,832	117	Now. Very low.
„ -	26	3,597	129	Now.
„ -	27	4,839	205	„
„ -	28	5,741	268	„
„ -	29	7,093	335	Ordinarily. Very full.
	30	2,742	99	Now. The lowest.
„ -	31	7,552	345	Ordinarily. Very full.
	32	- - -	- - -	Now.
„ -	33	7,330	290	Ordinarily. Very full.
	34	- - -	- - -	Now.
„ -	35	2,963	164	Now. Very low.
„ -	36	5,487	197	Ordinarily.
	37	3,351	136	Now.
„ -	38	5,414	193	Ordinarily.
„ -	39	5,227	227	Now. Much of the carbo-hydrates.
„ -	40	3,405	129	

DIETARIES OF MARRIED PERSONS.

Details of Dietaries.

Families.

Table No. 41 contains an analysis of the dietaries of married persons, so far as relates to the quantity of nutritive elements consumed per head, and shows a diversity ranging from 6,560 grains to 2,071 grains of carbon, and from 275 grains to 91 grains of nitrogen daily. The larger quantity is by no means equal to the maximum, whilst the smaller is less than the minimum found amongst single persons. The former fact is partly due to the greater economy required by families than by single persons; but both are chiefly to be explained by the presence of young children in the families. The families are arranged in the table in the order of the number of members of the families, but there

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* The numbers attached to the tables are those of the same person wherever referred to in this Report. The tables (Nos. 5–40 inclusive), which give the details of these dietaries, are appended as a Supplement to the Report.

† The bracket indicates that both refer to the same person.

is not any variation in the amount of nutriment running parallel with mere number of members of the family, whilst it is seen that the least quantities are found in families with young children. In one-third of the cases the quantity of carbon consumed daily was less than 3,000 grains per head.

There are several instances in which the dietary is very well arranged, as in the case of 68, with a large family of grown-up children, and in that of 63, with a large family of young children. Cases 51 and 74 have also very good dietaries. A reference to the peculiarities of these dietaries will be found in Table No. 41.

TABLE No. 41.*

MARRIED PERSONS.

Showing the daily quantity of Carbon and Nitrogen consumed per head.

Persons in the Family.	No.	Carbon.	Nitrogen.	Remarks upon the Dietary.
		Grains.	Grains.	
Man and wife, 2	42	6,560	275	Ordinarily. } †Ate potatoes largely.
,,	43	3,072	120	Now.
,,	44	3,188	128	Now.
,,	45	4,389	173	Now.
Man, wife, and child, 3 -	46	3,051	117	Now.
Wife and 2 children -	47	4,475	193	Ordinarily. }
	48	3,353	138	Now.
4	49	3,288	137	Now.
	50	3,809	155	Now.
	51	3,459	147	Now. Good dietary.
5	52	3,333	154	Now. Much hydro-carbons.
	53	3,839	141	Ordinarily. }
	54	3,783	143	Now.
	55	2,200	92	Now. All adults; exceedingly low.
	56	3,549	153	Now.
	57			
6	58	3,193	180	Now. Much oatmeal.
	59	2,945	111	Now. Young children.
	60	2,275	85	Now. Exceedingly low. Young children
	61	3,590	144	Ordinarily. }
	62	2,808	115	Now.
	63	6,369	259	Ordinarily. } Very full. Five adults.
	64			Now.
7	65	2,792	111	Now. Young children.
	66	2,849	112	Now.
Wife and 6 children.	67			Now. Exceedingly low. Young children. Father lives apart.
	68			Now. }
	69	3,402	151	Ordinarily.
8	70	3,241	134	Now.

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* The tables (Nos. 42–87 inclusive), which give the details of these dietaries, are appended as a Supplement to the Report.

† The brackets indicate that both belong to the same family.

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Details of Dietaries.

Married Persons.

Table No. 41—*continued.*

Persons in the Family.	No.	Carbon.	Nitrogen.	Remarks upon the Dietary.
	71	2,071	91	Now.
	72	3,962	183	Ordinarily. Full diet. Much butter milk.
	73	2,818	112	Now. Young children. Much milk.
	74	3,578	144	Ordinarily. Good.
	75			Now. Good. Much hydro-carbons.
	76	2,742	111	Ordinarily. Low. Young children.
	77			Ordinarily and now.
9	78	4,179	166	Now. Much hydro-carbons.
	79	3,872	156	Ordinarily.
	80	2,945	129	Ordinarily. Best dietary with young children.
	81	2,940	133	Now.
	82	5,208	203	Ordinarily and now. Full.
10	83	2,989	135	Now. Very farinaceous. Much oatmeal.
11	84			
12	85	3,198	133	Now.
14	86	4,548	199	Ordinarily. Full. Children grown.
	87	3,826	175	Now. Very well arranged dietary.

PUBLIC DIETARIES IN PRESENT USE.

Public Establishments.

The essential feature of the dietaries in use by public bodies for the relief of persons residing at their own homes is that of supplying food for a meal separately, and not that which is found in workhouses and hospitals, where the people to be fed remain in the institution, and a fixed round of foods may be supplied on the several days of the week. Hence soup kitchens and cooking depôts for the benefit of the class of persons now under consideration offer but little variety of food, and indeed most of them have but one kind, or if they have two they are both fitted for the dinner only. In a few only is there provision made for the usual wants of this class at each of the meals of the day, so that tea, coffee, or rice milk may be obtained for the breakfast and tea, as well as the soup or potato hash for the dinner.

Hence in regarding the following tables we must look at them as supplying a single meal each at a certain nett cost, and containing a certain amount of nutritive matter. In the two latter particulars, as well as in the economical and dietetic arrangement of the foods, the tables may be compared with each other; but as bread or other separate food is commonly given with the meal, and its quantity varies in each establishment, we have not the means of showing the true nutritive value of the whole meal.

In some institutions a charge is made for each meal, and in a few it is purposely greater than sufficient to pay the actual cost of the foods; but as the object of this inquiry is not to regard them as commercial establishments, we need not refer to the sums which are charged at them. The object in collecting these details is to offer examples from which any dietary may be constructed, to point out the variety which now exists, and to show for how small a sum a sufficient meal may be prepared when the foods are purchased in the most advantageous manner, and prepared in large quantities.

Details of Dietaries.

Public Establishments.

But in estimating the true value of each dietary we must regard not only its economy but its sufficiency, for it is presumed that the quantity of nutriment offered at a meal is sufficient for the ordinary wants of a man or woman at the proper period of the day. It is in vain to show that a breakfast may be prepared for ½*d.*, or a dinner for 1*d.*, unless at the same time it be proved that the meal thus provided is sufficient for the consumer.

Hence in regarding these tables we must bear in mind the quantity of food which is required by the system, and if a given food, as soup, does not supply that amount, whatever may be its cost, it must be supplemented with bread or some other kind of food to meet the deficiency.

Required nutriment.

I have already stated that no dietary can be satisfactory which does not supply about 4,300 grains of carbon and 200 grains of nitrogen daily, and in apportioning this quantity to the meals of the day a separate estimate must be made of the requirements of the system at these periods.

It seems to be settled by common assent that at least three meals per day are necessary, although the conversation at Blackburn related in page 334, and the example of other nations might show that the health could be maintained on two sufficient meals daily.

Distribution of food during the day.

For the reasons already given I consider that it is wise, both for health and economy, to give the greater portion of the food at the breakfast and at the early dinner, and the proportion of carbon and nitrogen which is desirable at the three meals may be stated as follows :—

Meal.	Carbon.	Nitrogen.
	Grains.	Grains.
Breakfast - -	1,500	70
Dinner - - -	1,800	90
Tea - - -	1,000	40

And for women $\frac{1}{10}$th less.

Summary of nutritive values.

Table No. 88 contains a summary of the cost and nutritive value of each ration of food supplied by various institutions, derived from the details recorded in tables No. 89 to No. 172.

There are only three kinds of food suitable for the dinner, and of these two only, viz. soup and hash, are in common use ; the third, rice pudding, is found in only one institution.

Cost of food.

The nett cost of the soup varies very much, and with it the nutritive value varies in a general manner. The extremes of cost are ⅕*d.* and a little over 1½*d.* per ration, whilst those of the nutritive values is from 300 grains to 1,795 grains of carbon, and from 12 grains to 144 grains of nitrogen.* Those of a higher cost are very valuable, of which

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* The quantity which constitutes a ration is given at the head of each table, but as in some instances persons buy the foods, and may purchase any quantity above a minimum at a time, and as in others a minimum quantity is supplied to a family, including children, it will be necessary, in comparing the nutritive values and cost of the food in the different tables, to have regard to the quantity which is stated to constitute the ration.

Details of Dietaries.

Public Establishments.

Soup and hash.

may be mentioned the Ardwick, Preston, Wigan, Blackburn, and Stockport dietaries, and these, with a small allowance of bread, offer for the most part abundant nourishment. The cost and nutritive value of the potato hash is, on the average, higher than that of the soup, but there is always the disadvantage to individual consumers of the unequal distribution of the meat, however small may be the portions in which it is usually cooked. With this exception it is probably a better and a more generally agreeable food than the soup, where the income will admit of the expense; but under all circumstances it offers a most valuable alternative dietary with the soup. The extremes of cost are ·64*d.* and 2·32*d.*, whilst those of nutriment are 491 and 2,038 grains of carbon and 25 and 80 grains of nitrogen.

Potato pie.

There are two instances of potato pie recorded in the tables, both of which are excellent, and the latter purposely excessive, so that a portion of it may be taken away, if preferred—that of the Gaythorn Cooking Depôt, at a cost of 1·16*d.*, and that of the Mother's Kitchen at Blackburn, at 3·3*d.* per ration. The crust to the pie adds greatly to its value, the juices of the meat are better retained, and the food is served more uniformly at a high temperature. If the ration could be fairly estimated and the meat properly distributed, this would be the best kind of food offered in these dietaries.

Rice pudding.

The rice pudding supplied at Ardwick is an excellent change of diet, and when supplemented with bread and cheese, or bread and bacon, offers a sufficient supply of food.

Food for breakfast and tea.

The foods offered for breakfast are rice milk, porridge, gruel, coffee, and tea, and the tables show the very small nutritive value of the two latter,—the ordinary foods of the people. The rice milk or porridge with bread offers a sufficient and far more nutritive meal than tea or coffee with bread, at the same cost. In some of these dietaries a large, and as I think, an excessive supply of sugar is given, as for example, in the coffee at Messrs. Wood's, at Wigan, and the New Institution, Pendleton. As sugar is a dear food in relation to its nutritive value, no more should be given than will make the food palatable, whilst milk added in larger quantity than at present would increase the nutritive value—an increase greatly needed.

Upon the whole, whilst the greatest merit is due to those who have established the supply of food now so largely offered to the poor, with dietaries such as they could readily devise or procure, it is well to know that many of the dietaries are insufficient for the wants of the system, and that it will be better to increase their nutritive value, although it will imply an increased cost. In such instances the distribution of food is illusory, since the recipients and the public assume that the quantity supplied is sufficient for a meal.

APPENDIX.

V. The Cotton Famine.

3. Economics of diet. By Dr. E. Smith.

Details of Dietaries.

Public Establishments.

Summary of Cost and Nutritive Values of Public Dietaries.

TABLE No. 88.*

SUMMARY of the Cost and Nutritive Values of the Food supplied by Sou Kitchens, &c.

Soup.

TOWN.	INSTITUTION.	PER RATION.			REMARKS.
		Cost.	NUTRITIVE VALUE.		
			Carbon.	Nitrogen.	
	SOUP.				
	Table.	*d.*	Grains.	Grains.	
MANCHESTER	89. The New Institution, Pendleton (Sir Elk. Armitage and Sons).	·51	450	33	
	90. Ardwick, Miss Hilton's -	·91	595	27	Vegetable.
	91. " "	1·24	873	61	
	92. Mr. Birch's Sewing Classes	·56	510	38	
	93. Messrs. Crewdson's Factory	·57	369	18	
	94. Drake Street Soup Kitchen	·66	776	61	
	95. District Provident Sewing School.	·6	929	84	Besides baco liquor.
	96. Friend's Soup Kitchen -	1·	935	68	
	97. Gaythorn Cooking Depôt -	·18	300	12	Broth.
	98. " " -	·25	490	36	Vegetable.
	99. Institute for the Unemployed	·44	492	32	
	100. St. Jude's - - -	·8	913	72	
	101. St. Mark's - -	·58	822	58	
	102. St. Philip's - -	·89	1,242	65	Bacon only.
	103. Messrs. Stirling's Factory -	·72	665	50	For men.
	104. " " -	·55	432	34	For women.
WIGAN -	105. Messrs. Eckersley and Son's Factory.	1·55	956	43	
	106. Messrs. W. Wood and Son	1·57	975	53	
	107. Messrs. J. Wood and Co. -	1·51	947	68	
PRESTON -	108. Preston Relief Fund -	1·24	1,402	52	
BLACKBURN -	109. Mrs. Gladstone's Soup Kitchen.	·94	1,048	75	
	110. Polydore Soup Kitchen -	1·	1,076	67	
	111. Shakespeare Mill - -	1·25	969	58	
ASHTON-UNDER-LYNE	112. Charlestown Soup Kitchen-		581	40	
	113. Sewing Classes - -	·48	328	20	
	114. " " - -	·44	549	39	
STOCKPORT -	115. Brinksway - -	·4	446	34	
	116. Edgeley District Relief -	1·1	702	35	Scotch broth.
	117. " " " -	·88	451	27	
	118. " " " -	·67	404	26	

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* The tables (Nos. 89–174), which give details regarding the several articles of food named i this Summary, are appended as a Supplement to the Report.

TABLE No. 88—*continued.*

TOWN.	INSTITUTION.	PER RATION.			REMARKS.
		Cost.	NUTRITIVE VALUE.		
			Carbon.	Nitrogen.	
	SOUP—*continued.*				
	Table.	*d.*	Grains.	Grains.	
STOCKPORT	119. Edgeley District Relief -	1·3	1,300	81	
	120. „ „ „ -	·95	662	51	
	121. Kingston Mill - -	·54	587	46	
	122. Lancashire Hill Soup Kitchen	1·36	1,136	84	
	123. „ „ „	1·64	936	45	Barley broth.
	124. Portwood Soup Kitchen -	1·67	1,795	144	
	125. St. Mary's Soup Kitchen -	- -	639	54	
	126. Messrs. Thorneley and Co.'s Mill.	·3	371	58	
	POTATO HASH, IRISH STEW, OR SCOUSE.				
MANCHESTER	127. Sir Elk. Armitage and Sons	·9	911	33	
	128. Ardwick Cooking Kitchen	1·34	1,269	50	
	129. Mr. Birch's Sewing Classes, 220, City Road.	·98	788	34	
	130. Do. Institute for the Unemployed.	1·9	1,701	74	
	131. Mr. Cooke's, Oxford Road -	1·42	1,269	50	
	132. District Provident Sewing School.	1·19	1,032	39	
	133. Gaythorn Cooking Depôt -	1·16	878	33	Potato pie.
	134. St. Jude's „ „	1·06	1,005	55	
	135. St. Philip's „ „	1·05	1,229	34	
	136. Messrs. Stirling's Mill -	1·04	810	34	For men.
	137. „ „ -	·86	698	28	For women.
WIGAN -	138. Messrs. Wm. Woods and Son's Mill.	1·6	1,262	60	
PRESTON -	139. Preston Relief Fund -	1·37	1,329	48	
BLACKBURN -	140. Mrs. Gladstone's Soup Kitchen.	1·83	1,753	67	
	141. Mother's Kitchen - -	3·3	2,884	109	Potato pie.
	142. St. Peter's Married Men's School.	1·72	1,720	64	
ASHTON-UNDER-LYNE.	143. Sewing Classes - -	·7	491	20	
STOCKPORT -	144. Edgeley District Relief -	1·7	1,695	63	
	145. „ „ „ -	1·24	1,137	43	
	146. Lancashire Hill Sewing School.	2·07	1,767	70	
	147. Portwood Soup Kitchen -	2·32	2,038	80	
	148. St. Mary's Soup Kitchen -	·75	769	28	
	149. Messrs. Thos. Thorneley and Co's Mill.	·64	744	25	

Soup.

Hash.

APPENDIX.

V. The Cotton Famine.

3. Economics of diet. By Dr. E. Smith.

Details of Dietaries.

Public Establishments.

TABLE No. 88—*continued.*

Rice milk or pudding. Porridge. Tea. Coffee. Sick dietaries.

TOWN.	INSTITUTION.	PER RATION.			REMARKS.
		Cost.	NUTRITIVE VALUE.		
			Carbon.	Nitrogen.	
	RICE MILK.				
	Table.	*d.*	Grains.	Grains.	
MANCHESTER	150. Ardwick Cooking Kitchen	1·73	1,445	44	Rice pudding.
	151. District Provident Sewing School.	·43	437	15	
	152. St. Jude's ,, -	·94	866	33	
	153. The New Institution, Pendleton.	·94	631	26	
STOCKPORT -	154. Brinksway Soup Kitchen -	·64	893	24	Barley porridge.
	155. Messrs. Thorneley and Co.'s Mill.	·47	550	18	
	156. Edgeley District Relief -	1·07	878	30	
	PORRIDGE.				
PRESTON -	157. Preston Relief Fund -	·58	1,028	28	Sweet soup.
STOCKPORT -	158. Messrs. Thorneley and Co.'s Mill.	·49	855	29	
	TEA.				
MANCHESTER	159. Ardwick Cooking Kitchen	·5	105	3	
	160. Mr. Birch's Institute for the Unemployed.	·27	89	2	
	161. Gaythorn Cooking Depôt -	·9	107	2	
	162. The New Institution, Pendleton.	1·8	394	13	
STOCKPORT -	163. Kingston Mill - -	·39	154	4	
	COFFEE.				
MANCHESTER	164. Ardwick Cooking Kitchen	·36	123	4	
	165. Mr. Birch's Sewing Classes	·28	91	1	
	166. District Provident Sewing School.	·44	154	3	
	167. Gaythorn Cooking Depôt -	·4	107	2	
	168. The New Institution, Pendleton.	·8	152	5	
	169. Messrs. Stirling's Mills -	·23	62	8	
WIGAN -	170. Messrs. Wm. Woods and Son's Mills.	1·28	597	9	
BLACKBURN -	171. Mrs. Gladstone's Soup Kitchen.	·8	253	4	
STOCKPORT -	172. Heaton Reddish School -	·37	124	2	
BLACKBURN -	173. SICK DIETARIES.				
PRESTON -	174. SICK DIETARIES.				

The Dietaries proposed for the Unemployed Factory Operatives.

Proposed Dietaries.

Prices of food.

In preparing schemes of dietary at a definite cost it is necessary that a fixed price be determined upon for each article to be used, and upon the whole I think it best to adopt nearly the lowest price for which the food is commonly bought. As the price varies much in every place, and that of some articles, as milk, whilst nearly constant in the same, differs in different towns, the actual cost to the consumers may at their discretion be somewhat more than I shall quote ; but for the purposes of this report it is a duty that the cost should be the lowest at which the food can be procured. Moreover, I shall use the lowest retail price in the construction of private and the lowest wholesale in that of public dietaries.

The following are the retail prices which I shall quote:—Bread 1½*d.* lb., flour 1¾*d.* lb., oatmeal 1¾*d.* lb., rice 1½*d.* lb., peas 1½*d.* lb., potatoes 1*s.* 20 lbs., carrots and turnips ½*d.* lb., onions ¾*d.* lb., beef 6*d.* lb., bacon (American) 4*d.* lb., liver 3½*d.* lb., cheese 6*d.* lb., skimmed milk ½*d.* pint, butter milk ¼*d.* pint, mutton fat 5*d.* lb., mutton suet 6*d.* lb., sugar 4*d.* lb., butter 10*d.* lb., treacle 2*d.* lb., tea 3*d.* oz., dripping 6*d.* lb.

It will also be convenient to arrange the tables under three heads.

Arrangement.

1. Foods for breakfast, dinner, and tea for separate persons cooked at home.
2. The same supplied by public kitchens.
3. The articles of food which may be used at discretion during a week.

Model dietary.

As a general principle I assume that three meals per day will be taken, and as a model dietary I premise the following :—

Breakfast ; milk, oatmeal, and bread, with bacon or herring, if possible.

Dinner ; meat or bacon, or herring with bread, and fresh vegetables, cooked in various ways, and if possible cheese or pudding.

Tea ; tea or coffee, milk, oatmeal, and bread.

Tea and coffee.

Whenever tea or coffee is taken the cost will be greater, and consequently for the same cost the nutriment will be less; and hence, if either must be taken, it should be reserved for the evening meal.

Milk.

Whenever it is practicable the skimmed milk and butter milk to be used should be previously heated with one teaspoonful of flour and half an ounce of mutton fat per pint, and to the butter milk should also be added a little allspice, and thus render them in nutritive value nearly equal to new milk.

Mode of calculating cost.

As it is impossible to calculate the cost of each article in each meal correctly with reference to the value of our coins, I have calculated the cost of each for eight meals, so as to enable me the better to divide the cost of the pound.

Cost of each meal.

The cost of the breakfast should be 1¼*d.* to 1½*d.* ; of the dinner 1½*d.* to 2*d.* ; and of the tea 1*d.*

In tables which are appended as a Supplement to the Report (Nos. 175–202 inclusive), I have given details for suitable dietaries at these and slightly different prices.*

I have also given in the same place (Nos. 203–206 inclusive), details for suitable soups to be provided at public kitchens. The prices are

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* Salt, spice, herbs, and seasoning must be added according to the taste of the individual.

Appendix. V. The Cotton Famine. 3. Economics of diet. By Dr. E. Smith. Proposed Dietaries.

wholesale. The soups may be eaten for dinner or for any other meal, and with 6 ounces of bread will yield more nutriment than is required for the dinner. They are purposely intended to be thick, but if it be desirable to reduce the nutritive value, as for women and children, 25 pints more water may be added, so as to increase the full ration to $1\frac{1}{2}$ pints, and half or two-thirds of it given, as may be preferred.

The formulæ nearly agree in the quantity of meat, but differ in the proportion of dry and fresh vegetable food. The milk soup, having a more delicate flavour, is perhaps better suited to children and the aged. In their preparation and distribution it is essential that either the whole or three of them be cooked and supplied each on consecutive days, or that the flavour of the same soup be varied on succeeding days, so as to give the variety which the palate demands. In each the seasoning may be varied at discretion; but whilst avoiding a too free use of salt, other seasoning should be used freely. The dry vegetables should be creed, the bones (sawn into small portions) stewed, and the fresh vegetables crushed before they are mixed together for the soup, and the whole should be softened and well cooked by being kept at a simmering heat only. In the milk soup the flour and spice should be first well warmed with the milk, and the whole added after the meat and dry vegetables have been cooked.

WEEKLY DIETARIES FOR AN ADULT.

Weekly Dietaries. Plan of Construction.

The construction of weekly dietaries is not so valuable as that of dietaries for single meals, since, in the course of a week or weeks, the tastes of the individual will vary, and the tastes of different persons are seldom similar, even for a day. Hence it is important that in weekly dietaries, where the food is to be cooked at home, there be much liberty allowed in the selection; and for this purpose I have thought it best to introduce numerous dietaries of different values, both in pecuniary cost and nutritive elements, and yet having regard to age, sex, and size, all agreeing in supplying a sufficient amount of nutriment, and in being within the limits allowed by the questions proposed to me. These dietaries are appended in Tables Nos. 207–225 inclusive, and those of them which are inserted last may be regarded as answers to question 3, viz. :—" What, with the same special reference (to health), would be " the most useful expenditure of small additional sums, say 25 and 50 " per cent. on the minimum granted for the same exclusive purpose " (the purchase of food)?"

Cheapest foods.

As a general guide it may be stated that in very low-priced dietaries bread must form almost the sole source of nutriment, since it is the only food which can furnish the required quantity of nutriment at the limited cost, with the daily constancy permitted by the appetite. The best addition of the same kind is oatmeal. The cheapest kind of fat is that of bacon, and next, that of dripping. The cheapest source of nitrogen, in a food which may be eaten constantly, is butter milk, and next, skimmed milk. The cheapest solid animal food is fish, as herring, but it cannot be eaten with advantage continually. The most economical sweet is treacle; and as a continuous supply of fresh vegetable, potato is the best. In the following dietaries I have usually allowed 2*d.* weekly for fresh vegetables, and where the weekly cost of food exceeds 2*s.*, this may be allowed. This will purchase $3\frac{1}{4}$ lbs. of potatoes weekly, or 2 lbs. of potatoes and 1 lb. of onions, or 2 lbs. of potatoes and 2 lbs. of carrots, any of which, probably, offer a sufficient supply of fresh vegetable juices. It is also to be desired that cabbage and turnip-tops in their season should form a part of the dietary, and the latter may often be obtained without cost.

Foods selected.

Hence in the following tables I have given much prominence to bread, oatmeal, milk, bacon, and fresh vegetables, whilst tea and coffee, sugar, and expensive fats, I have used sparingly. The tables are arranged in the order of the weekly cost.

Number of meals with the food recommended.

The aim in the selection of food has been to provide three meals, each having the customary character. The breakfast will consist of bread and milk, rice milk and bread, milk porridge with bread, oatmeal brose with milk or treacle, or coffee with milk, sugar or treacle, and some kind of fat and bread. Butter milk will sometimes wholly or partially supplant milk. The dinner will consist of meat, bacon, liver or herring, with vegetables and bread. Sometimes pudding made of oatmeal, rice, or flour, will be added to or supplant the animal food, and occasionally butter milk is provided as a beverage.

The evening meal will usually consist of oatmeal and milk porridge with bread, or oatmeal brose with treacle or dripping, or coffee or tea with sugar, milk and bread, to which butter, dripping or treacle is added.

Hence bread will be eaten with milk porridge or meat, or with the addition of treacle, butter or dripping ; flour will be used in making porridge or pudding ; oatmeal in making porridge or brose, and eaten with milk or butter milk ; rice in rice milk or pudding, or eaten dry with treacle, dripping or meat ; peas with bacon or liver ; coffee with boiled milk and sugar or treacle ; and suet with rice or flour.

It is not necessary to enter at any length into the answer to question 3, since the tables already referred to supply it practically. It may suffice to state that such additional dietaries would be especially applicable to persons of large stature, to the sick, and to the aged. The former would demand a larger amount of bread and meat, such as is indicated in Table No. 224, while the sick and aged would need a larger proportion of the luxuries or comforts of foods. To the latter, therefore, a larger addition of tea, coffee, butter, and perhaps meat might be allowed, and the articles should be of better flavour and quality, as, for example, new milk and fresh butter. In Table No. 225 I have endeavoured to provide for this class of wants, and to give much variety in the dietary.

The dietary for the sick is a subject of the gravest interest and calls for early and careful attention, but it is not included in the inquiry to which this report refers.

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Details of Dietaries.

Single Persons.

SUPPLEMENT.

TABLE No. 5.

PRESTON—[Now].

COST . . per Head weekly . . 3*s.* 6½*d.*
INCOME . . . . . weekly . . 3*s.* 6*d.*
CARBON . per Head daily . . . grains.
NITROGEN per Head daily . . . grains.
FAMILY, 1 Male, aged 18.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	10	0 1½	1 3	19,680	920
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	1½	0 2	0 3	4,152	210
Peas.					
Rice.					
Potatoes - lb.	5	1/0 20lb.	0 3	3,500	120
Onions.					
Turnips.					
Sugar - - lb.		0 5	0 2½	1,384	
Treacle - lb.		0 1½	0 3	4,480	
Butter - lb.		0 10	0 2½	1,058	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 6	0 3	2,376	48
Meat.					
Meat, reckoned without bone.					
Herrings - -	2	0 0½	0 1		
Milk, new.					
,, skimmed pint	1½	0 1	0 1½	657	64
Butter milk.					
Cheese - - oz.	2	0 8	0 1	332	40
Tea.					
Coffee - - oz.	1	0 1	0 1	- -	5
Chicory.					
Soup - - pint	8	0 0¾	0 6		
TOTAL -	- -	- -	3 6½		

TABLE No. 6.

PRESTON—[Now].

COST . . per Head weekly . . 3*s.* 2½*d.*
INCOME . . . . . weekly . . 3*s.* 6*d.*
CARBON . per Head daily . . . 4,358 grains.
NITROGEN per Head daily . . . 285 grains.
FAMILY, 1 Male, aged 21.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	10½	0 1½	1 3½	20,664	966
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	½	0 6	0 3	1,384	
Treacle.					
Butter - - lb.	¼	1 0	0 3	1,176	
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat.					
Meat, reckoned as bone.					
Herrings - -	21	0 0½	0 10½	5,647	861
Milk, new.					
,, skimmed pint	3½	0 1	0 3½	1,633	150
Butter milk.					
Cheese.					
Tea - - oz.	½	0 3	0 1½	- -	5
Coffee - - oz.	2	0 0¾	0 1½	- -	10
Chicory.					
TOTAL -	- -	- -	3 2½	30,504	1,992

When he has not enough money he buys only 8 lbs. of bread.

TABLE No. 7.

PRESTON—[Now].

COST . . per Head weekly . . 1*s.* 11½*d.*
INCOME . . . . . weekly . . 3*s.* 1*d.*
CARBON . per Head daily . . . 4,787 grains.
NITROGEN per Head daily . . . 133 grains.
FAMILY, 1 Male, aged 21.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	10	0 1½	1 2½	19,680	920
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	1	0 5	0 5	2,768	
Treacle.					
Butter - - lb.	¼	0 10	0 2½	1,058	
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea.					
Coffee - - oz.	2	0 0¾	0 2½	- -	10
Chicory.					
TOTAL - -	- -	- -	1 11½	33,506	930

The numbers attached to the tables are those of the same person wherever referred to in this report.

Table No. 8.

PRESTON—[Now].

Cost . . per Head weekly . . 2*s.* 11*d.*
Income . . . . . weekly . . 3*s.* 6*d.*
Carbon . per Head daily . . . 5,370 grains.
Nitrogen per Head daily . . . 236 grains.
Family, 1 Male, aged 18.

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread - - lb.	14	0 1½	1 9	27,552	1,288
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	1	0 1½	0 1½	2,768	140
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar.					
Treacle - - lb.	1	0 2	0 2	2,240	
Butter - - lb.	¼	0 8	0 2	1,058	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 4	0 2	2,139	39
Meat.					
Meat, reckoned without bone.					
Herrings -	4	0 0½	0 2	1,076	161
Milk, new.					
„ skimmed pint	1½	0 1	0 1½	657	64
Butter milk.					
Cheese.					
Tea - - oz.	½	0 3	0 1½	- -	5
Coffee - - oz.	2	0 0¾	0 1½	- -	10
Chicory.					
Total -	- -	- -	2 11	37,590	1,707

Table No. 9.

ASHTON—[Now.]

Cost . . per Head weekly . . 2*s.* 2*d.*
Income . . . . . weekly . . 2*s.* 2*d.*
Carbon . per Head daily . . . 4,528 grains.
Nitrogen per Head daily . . . 165 grains.
Family, 1 Male, aged .

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0		
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes.					
Onions - - lb.	2	0 0¾	0 1½	840	42
Turnips.					
Sugar.					
Treacle - - lb.	1	0 2	0 2	2,240	
Butter.					
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 6	0 3	2,376	48
Meat.					
Meat, reckoned without bone.					
Herrings - -		0 0½	0 1½	807	123
Milk, new - pint		- -	0 1	364	28
„ skimmed.					
Butter milk.					
Cheese - - lb.	½	- -	0 3	1,328	158
Tea - - oz.	½	0 3	0 1½	- -	5
Coffee - - oz.		1/8 lb.	0 2½	- -	10
Chicory.					
Total -	- -	- -	2 2	31,699	1,150

Table No. 10.

MANCHESTER—[Ordinarily and Now].

Cost . . per Head weekly . . 4*s.* 5½*d.*
Income . . . . . weekly . . 9*s.* to 10*s.*
Carbon . per Head daily . . . 5,183 grains.
Nitrogen per Head daily . . . 206 grains.
Family, 1 Female, aged 58 (saved 40*l.*)

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	1¼	- -	0 2½	3,460	175
Peas.					
Rice.					
Potatoes - lb.	5+5	1*s.* 20lbs.	0 3	7,000	240
Onions.					
Turnips.					
Sugar - - lb.	¾	0 6	0 4½	2,076	
Treacle.					
Butter - - lb.	½	1 0	0 6	2,352	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 7	0 3½	2,376	48
Meat - - lb.	1	- -	- -	2,580	160
Meat, reckoned without bone.					
Herrings.					
Milk, new - pints	⅔	- -	0 1	364	28
„ skimmed.					
Butter milk.					
Cheese - - oz.	2	8*d.* lb.	0 1	332	40
Tea - - oz.	1	0 3	0 3	- -	10
Coffee - - oz.	2	0 1	0 2	- -	10
Chicory.					
5 dinners of meat and potatoes -	- -	0 3	1 3		
Total -	- -	- -	4 5½	36,284	1,447

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TABLE No. 11.

MANCHESTER—[NOW].

COST . . per Head weekly . . 3*s.* 0½*d.*
CARBON . per Head daily . . . 5,169 grains.
NITROGEN per Head daily . . . 230 grains.
FAMILY, 1 Female, aged 19.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	14	0 1½	1 9	27,552	1,288
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	5	1*s.*20lbs.	0 3	3,500	120
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	1,384	
Treacle.					
Butter.					
Lard.					
Dripping - lb.	¼	0 8	0 2	1,330	
Suet.					
Bacon - - lb.	¼	0 8	0 2	1,188	24
Meat.					
Meat, reckoned without bone.					
Herrings.	3	- -	0 1½	807	123
Milk, new.					
,, skimmed.					
Butter milk pint	1	0 0½	0 0½	420	43
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	10
Coffee - - oz.	1	0 1	0 1	- -	5
Chicory.					
TOTAL -	- -	- -	3 0½	36,181	1,613

TABLE No. 12.

WIGAN—[ORDINARILY].

COST . . per Head weekly . . 6*s.* 2*d.*
CARBON . per Head daily . . . 8,554 grains.
NITROGEN per Head daily . . . 373 grains.
FAMILY, 1 Female, aged 20.

(*Same person as No.* 13.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	16	0 1½	2 0	31,488	1,472
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	3	0 1¾	0 5¼	8,304	420
Peas.					
Rice - - lb.	½	0 3	0 1½	1,344	35
Potatoes - lb.	5	1*s.*20lbs.	0 3	3,500	120
Onions.					
Turnips.					
Sugar - - lb.	1	0 5	0 5	2,768	
Treacle - - lb.	½	0 2	0 1	1,120	
Butter - - lb.	½	1 0	0 6	2,352	
Lard.					
Dripping.					
Suet - - lb.	¼	0 8	0 2	1,176	
Bacon - - lb.	½	0 6	0 3	2,376	48
Meat (Sunday) lb.	1	0 7	0 7	2,580	160
Meat, reckoned without bone.					
Herrings - -	3	- -	0 2¼	807	123
Milk, new - pint	1⅓	- -	0 2	728	57
,, skimmed.					
Butter milk.					
Cheese - - lb.	½	0 8	4	1,328	158
Tea - - oz.	1	0 3	0 3	- -	10
Coffee - - oz.	2	0 1	0 2	- -	10
Chicory.					
TOTAL -	- -	- -	6 2	59,881	2,613

Not being well, drank two glasses of bitter beer daily.

TABLE No. 13.

WIGAN—[NOW].

COST . . per Head weekly . . 3*s.* 1¾*d.*
CARBON . per Head daily . . . 4,826 grains.
NITROGEN per Head daily . . . 188 grains.
FAMILY, 1 Female.

(*Same person as No.* 12.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	2	0 1¾	0 3½	5,536	280
Peas.					
Rice - - lb.	½	0 3	0 1½	1,344	35
Potatoes - lb.	5	1*s.*20lbs.	0 3	3,500	120
Onions.					
Turnips.					
Sugar - - lb.	¾	0 5	0 3¾	2,076	
Treacle.					
Butter - - lb.	½	0 10	0 5	2,117	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 6	0	2,376	48
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new - pints	2	0 1½	0 3	1,092	86
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	10
Coffee.					
Chicory - -					
TOTAL -	- -	- -	3 1¾	33,785	1,315

TABLE No. 14.

PRESTON—[NOW].

COST . . per Head weekly . . 2s. 2½d.
INCOME . . . . 3s.
CARBON . per Head daily . . . grains.
NITROGEN per Head daily . . . grains.
FAMILY, 1 Female, aged 18.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	2	- -	0 1½	1,520	48
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	1,384	
Treacle.					
Butter - - oz.	2	8d. lb.	0 1	529	
Lard - - oz.	1	8d. lb.	0 0½	332	
Dripping.					
Suet.					
Bacon - - lb.	¼	0 6	0 1½	1,188	24
Meat.					
Meat, reckoned without bone.					
Herrings - -	2	- -	0 1½	538	82
Milk, new - pint	⅓	- -	0 0½	182	14
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	½	0 3	0 1½	- -	5
Coffee.					
Chicory.					
Soup - pints.	6	0 0¾	0 4½		
TOTAL -	- -	- -	2 2½		

TABLE No. 15.

PRESTON—[ORDINARILY].

COST . . . per Head weekly . . 4s. 6¼d.
INCOME . . . . 10s.
CARBON . per Head daily . . 5,822 grains.
NITROGEN per Head daily . . 218 grains.
FAMILY, 1 Female, aged 19.

(Same person as No. 16.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	1½	0 2	0 3	4,152	210
Peas.					
Rice - - lb.	½	0 4	0 2	1,344	35
Potatoes - lb.	10	1s.20lbs.	0 6	7,600	240
Onions.					
Turnips.					
Sugar - - lb.	1	0 5½	0 5½	2,768	
Treacle.					
Butter - - lb.	½	1 2	0 7	2,252	
Lard - - lb.	¼	0 8	0 2	1,330	
Dripping.					
Suet.					
Bacon - - lb.	¾	0 7½	0 5¾	3,464	72
Meat.					
Meat, reckoned without bo ne.					
Herrings - -		- -	0 0½	269	41
Milk, new.					
,, skimmed pints	3½	0 1	0 3½	1,633	150
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	10
Coffee - - lb.	¼	1 4	0 4	- -	20
Chicory.					
TOTAL -	- -	- -	4 6¼	40,756	1,524

TABLE No. 16.

PRESTON—[NOW].

COST . . . per Head weekly . . 3s. 3½d.
CARBON . per Head daily . . . 5,643 grains.
NITROGEN per Head daily . . . 253 grains.
FAMILY, 1 Female.

(Same person as No. 15.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	3	0 1½	0 4½	8,304	420
Peas.					
Rice.					
Potatoes - lb.	10	1s.20lbs.	0 6	7,600	240
Onions.					
Turnips.					
Sugar - - lb.	¾	0 5½	0 3¾	2,076	
Treacle.					
Butter - - lb.	¼	1 0	0 3	1,176	
Lard - - oz.	2	0 0½	0 1	665	
Dripping.					
Suet.					
Bacon - - lb.	¼	0 6	0 1½	1,188	24
Meat - - lb.	¼	0 6	0 1½	645	40
Meat, reckoned without bone.					
Herrings - -	7	0 0½	0 3½	1,883	281
Milk, new.					
,, skimmed pint	½	- -	0 0½	219	22
Butter milk.					
Cheese.					
Tea - - oz.	¾	0 3	0 2¼	- -	7
Coffee.					
Chicory.					
TOTAL -	- -	- -	3 3½	39,500	1,770

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TABLE No. 17.

PRESTON—[ORDINARILY].

COST . . per Head weekly . . 6*s.* 6*d.*
INCOME . . . . . weekly . . 11*s.*
CARBON . per Head daily . . . 6,179 grains.
NITROGEN per Head daily . . . 233 grains.
FAMILY, 1 Female.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and barm lb.	9	0 2	1 7½		
Flour, reckoned as bread - lb.	12½	- -	- -	24,108	1,150
Oatmeal.					
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	1¼	0 6	0 8	3,460	
Treacle.					
Butter - - lb.	1½	1 2	1 9	7,056	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 7	0 3½	2,376	48
Meat - - lb.	2	0 8	1 4	5,160	320
Meat, reckoned without bone.					
Herrings.					
Milk, new, on Friday - pint	2	- -	0 2	1,092	86
Milk, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	2	0 3¼	0 6½	- -	20
Coffee - - oz.	2	0 0¾	0 1½	- -	10
Chicory.					
TOTAL - -	- -	- -	6 6	43,252	1,634

TABLE No. 18.

PRESTON—[NOW].

COST . . per Head weekly . . 2*s.* 3½*d.*
INCOME . . . . 3*s.*
CARBON . per Head daily . . . 2,783 grains.
NITROGEN per Head daily . . . 108 grains.
FAMILY, 1 Female.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	1,384	
Treacle.					
Butter - - lb.	½	1 2	0 7	2,352	
Lard.					
Dripping.					
Suet.					
Bacon,					
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
„ skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	2	0 3	0 6	- -	20
Coffee.					
Chicory.					
TOTAL - -	- -	- -	2 3½	19,480	756

TABLE No. 19.

PRESTON—[ORDINARILY].

COST . . per Head weekly . . 6*s.* 7*d.*
INCOME . . . . 9*s.*
CARBON . per Head daily . . . 7,475 grains.
NITROGEN per Head daily . . . 299 grains.
FAMILY, 1 Female.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	12	0 2	2 1	32,844	1,541
Flour, reckoned as bread - lb.	16¾	- -	- -		
Oatmeal.					
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	1½	0 6	0 9	4,152	
Treacle.					
Butter - - lb.	1	1 3	1 3	4,704	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	¾	0 8	0 6	3,564	72
Meat - - lb.	2	0 8	1 4	5,160	320
Meat, reckoned without bone.					
Herrings.					
Milk, new - pint	3½	1 0	0 3½	1,900	150
„ skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1½	0 3	0 4½	- -	15
Coffee.					
Chicory.					
TOTAL - -	- -	- -	6 7	52,324	2,098

TABLE No. 20.

PRESTON—[Now].

COST . . per Head weekly . . 1*s.* 9*d.*
INCOME . . . . . weekly . . 3*s.* 0*d.*
CARBON . per Head daily . . . 3,801 grains.
NITROGEN per Head daily . . . 165 grains.
FAMILY, 1 Female, aged 20.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	12	0 1½	1 5	23,616	1,104
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar.					
Treacle - lb.	½	2	0 1	1,120	
Butter.					
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	¼	0 4	0 1	1,069	20
Meat.					
Meat, reckoned without bone.					
Herrings - -	3	- -	0 1	807	123
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea.					
Coffee - - oz.	1	- -	0 1	- -	5
Chicory.					
TOTAL -	- -	- -	1 9	26,612	1,252

Saves 3*d.* weekly to redeem her clothes.

TABLE No. 21.

PRESTON—[Now].

{ COST . . per Head weekly . . 2*s.* 0¾*d.*
{ INCOME . . . . . weekly . . 3*s.* 0*d.*
CARBON . per Head daily . . . 3,777 grains.
NITROGEN per Head daily . . . 165 grains.
FAMILY, 1 Female, aged 17.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	1½	0 2	0 3	4,152	210
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar.					
Treacle (to coffee) lb.	1	0 2	0 2	2,210	
Butter.					
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 4	0 2	2,139	39
Meat - - lb.	½	0 6	0 3	1,290	80
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed pint	2	0 1	0 2	876	86
Butter milk.					
Cheese.					
Tea.					
Coffee - - oz.	1	0 0¾	0 0¾	- -	5
Chicory.					
TOTAL -	- -	- -	2 0¾	26,441	1,156

TABLE No. 22.

PRESTON—[Now].

{ COST . . per Head weekly . . 1*s.* 11¾*d.*
{ INCOME . . . . . weekly . . 3*s.* 0*d.*
CARBON . per Head daily . . . 3,011 grains.
NITROGEN per Head daily . . . 109 grains.
FAMILY, 1 Female, aged 18.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	½	0 6	0 3	1,384	
Treacle - - lb.	1½	0 2	0 3	3,360	
Butter.					
Lard.					
Dripping.					
Suet.					
Bacon - - oz.	2	0 6	0 0¾	594	12
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	10
Coffee - - oz.	2	0 1	0 2	- -	10
Chicory.					
TOTAL -	- -	- -	1 11¼	21,082	768

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V. The Cotton Famine.

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TABLE No. 23.

PRESTON—[ORDINARILY].

COST . . per Head weekly . . 4*s.* 4*d.*
INCOME . . . . . weekly . . 10*s.*
CARBON . per Head daily . . . 5,171 grains.
NITROGEN per Head daily . . . 222 grains.
FAMILY, 1 Female.

(*Same person as No.* 24.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	10	0 1½	1 3	19,680	920
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	10	1/1 20lb.	0 6½	7,600	240
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	1,384	
Treacle.					
Butter - - lb.	¼	1 2	0 7	2,352	
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat - - lb.	1½	0 7	0 10½	3,870	240
Meat, reckoned without bone.					
Herrings.					
Milk, new, pint	3	0 1	0 3	1,314	129
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1½	0 3	0 4½	- -	15
Coffee - - oz.	2	0 1½	0 3	- -	10
Chicory.					
TOTAL - -	- -	- -	4 4	36,200	1,554

TABLE No. 24.

PRESTON—[NOW].

COST . . per Head weekly . . 2*s.* 2*d.*
INCOME . . . . . weekly . . 3*s.* 6*d.*
CARBON . per Head daily . . . 5,008 grains.
NITROGEN per Head daily : . . 156 grains.
FAMILY, 1 Female, aged 21.

(*Same person as No.* 23.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,745	736
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	1½	0 2	0 3	4,152	210
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar.					
Treacle - lb.	1½	0 2	0 3	3,360	
Butter.					
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed pint	3	0 1	0 3	1,314	129
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	10
Coffee - - oz.	2	0 1	0 2	- -	10
Chicory.					
TOTAL - -	- -	- -	2 2	35,061	1,095

TABLE No. 25.

PRESTON—[NOW].

COST . . per Head weekly . . 1*s.* 10*d.*
INCOME . . . . . weekly . . 3*s.*
CARBON . per Head daily . . . 2,832 grains.
NITROGEN per Head daily . . . 117 grains.
FAMILY, 1 Female, aged 21.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	1,384	
Treacle - - lb.	1	0 2	0 2	2,240	
Butter.					
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	¼	0 6	0 1½	1,188	24
Meat.					
Meat, reckoned without bone.					
Herrings - -	1	- -	0 0½	269	41
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	2	0 1¾	0 3½	- -	2
Coffee.					
Chicory.					
TOTAL - -	- -	- -	1 10	19,82	821

TABLE No. 26.

PRESTON—[Now].

COST . . per Head weekly . . 2s.
INCOME . . . . . weekly . . 3s.
CARBON . per Head daily . . . 3,597 grains.
NITROGEN per Head daily . . . 129 grains.
FAMILY, 1 Female, aged 20.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	5	1s.20lbs.	0 3	3,500	120
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	1,384	
Treacle - - lb.	½	0 2	0 1	1,120	
Butter - - lb.	¼	0 8	0 2	1,058	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 4	0 2	2,376	39
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea.					
Coffee - - oz.	2	0 0¾	0 1½	- -	10
Chicory.					
TOTAL -	- -	- -	2 0	25,182	905

TABLE No. 27.

BLACKBURN—[Now].

COST . . per Head weekly . . 2s. 10¼d.
INCOME . . . . 4s.
CARBON . per Head daily . . . 4,839 grains.
NITROGEN per Head daily . . . 215 grains.
FAMILY, 1 Female, aged 39.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	2	0 1½	0 3	26,076	1,242
Flour - - lb.	8	0 1½	1 0		
Flour, reckoned as bread -	11¼	- -	- -		
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	3½	1s.20lbs.	0 2	2,660	84
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	1,384	
Treacle.					
Butter - - lb.	¼	1 0	0 3	1,176	
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat - - lb.	1	0 6	0 6	2,580	160
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1½	0 3	0 4½	- -	15
Coffee - - oz.	1	- -	0 1¼	- -	5
Chicory.					
TOTAL -	- -	- -	2 10¼	33,876	1,506

Usually lives on 2s. 6d. weekly, and then has less bread and flour.

TABLE No. 28.

ASHTON—[Now].

COST . . per Head weekly . . 3s. 2d.
INCOME . . . . . weekly . . 4s. 6d.
CARBON . per Head daily . . . 5,741 grains.
NITROGEN per Head daily . . . 268 grains.
FAMILY, 1, aged .

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	12	0 1½	1 6	23,616	1,104
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	2½	1/6 10 lb.	0 4½	6,920	350
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar.					
Treacle - - lb.	1	0 2	0 2	2,240	
Butter.					
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	1	0 6	0 6	4,753	96
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese - - lb.	1	0 6	0 6	2,657	316
Tea.					
Coffee - - oz.	2	0 0¾	0 1½	- -	10
Chicory.					
TOTAL -	- -	- -	3 2	40,186	1,876

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Details of Dietaries.

Single Persons.

TABLE No. 29.

ASHTON—[ORDINARILY].

COST . . per Head weekly . . 5*s.* 2*d.*
INCOME . . . . . weekly . . 10*s.* 6*d.*
CARBON . per Head daily . . . 7,093 grains.
NITROGEN per Head daily . . . 335 grains.
FAMILY, 1 Female, aged 20.

(*Same person as No.* 30.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread.					
Flour and yeast, lb.	9	0 2	1 7		
Flour, reckoned as bread - lb.	12½	- -	- -	24,600	1,150
Oatmeal - lb.	4	0 1½	0 6	11,072	560
Peas.					
Rice.					
Potatoes - lb.	3¾	- -	- -	2,750	190
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	1,384	
Treacle - - lb.	1	0 2	0 2	2,240	
Butter - - lb.	½	1 0	0 6	2,352	
Lard.					
Dripping.					
Suet.					
Bacon* - - lb.	¼	0 8	- -	1,188	24
Meat - - lb.	¾	- -	- -	1,935	120
Meat, reckoned without bone.					
Herrings - -	3	0 0½	0 1½	807	123
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese - - lb.	½	0 8	0 4	1,328	158
Tea - - oz.	2	0 3	0 6	- -	20
Coffee.					
Chicory.					
Dinners, variously with or without meat - -	5	0 3	1 3		
TOTAL -	- -	- -	5 2	49,656	2,345

* Taken in alternate weeks with the cheese.

TABLE No. 30.

ASHTON—[NOW].

COST . . per Head weekly . . 2*s.* 2*d.*
INCOME . . . . . weekly . . 3*s.* 6*d.*
CARBON . per Head daily . . . 2,742 grains.
NITROGEN per Head daily . . . 99 grains.
FAMILY, 1 Female.

(*Same person as No.* 29.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread - - lb.	7	0 1½	0 10½	13,776	644
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes (Sunday) - - lb.	¾				
Onions.					
Turnips.					
Sugar - - lb.	1	0 4½	0 4½	2,768	
Treacle.					
Butter - - lb.	½	0 10	0 5	2,117	
Lard.					
Dripping - lb.	¼	0 8	0 2	1,330	
Suet.					
Bacon.					
Meat (Sunday) oz.	3	- -	0 1½	500	35
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea.					
Coffee - - oz.	2	0 0¾	0 1½	- -	10
Chicory.					
Dinner on Sunday, meat and potatoes - -	- -	- -	0 2		
TOTAL -	- -	- -	2 3	20,491	689

TABLE No. 31.

ASHTON—[ORDINARILY].

COST . . per Head weekly . . 5*s.* 10½*d.*
INCOME . . . . . weekly . . 10*s.*
CARBON . per Head daily . . . 7,552 grains.
NITROGEN per Head daily . . . 345 grains.
FAMILY, 1 Female, aged 20.

(*Same person as No.* 32.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread - - lb.	4	0 1½	0 6	32,372	1,518
Flour and yeast, lb.	9	0 2	1 7		
Flour, reckoned as bread - lb.	12½	- .	- -		
Oatmeal - lb.	1	0 1¾	0 1¾	2,768	140
Peas.					
Rice.					
Potatoes (Sunday ¾ lb.) lb.	5	1*s.*20lbs.	0 3	3,500	120
Onions - - lb.	2	0 0¾	0 1½	840	42
Turnips.					
Sugar - - lb.	1	0 5	0 5	2,768	
Treacle.					
Butter - - lb.	½	1 0	0 6	2,352	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	1	0 8	0 8	4,753	96
Meat (Sunday) oz.	3	- -	0 1½	500	35
Meat, reckoned without bone.					
Herrings - -	3	0 0½	0 1½	807	123
Milk, new.					
,, skimmed pint	1	- -	0 1¼	438	43
Butter milk.					
Cheese - - lb.	½	0 6	0 3	1,328	158
Tea - - oz.	2½	0 3	0 7½	- -	30
Coffee - - oz.	1	0 1	0 1	- -	5
Chicory.					
Eggs - - -	4 or 5	- -	0 3	440	105
Dinner, Sunday, meat & potatoes	1	- -	0 3		
TOTAL -	- -	- -	5 10½	52,866	2,415

TABLE No. 32.

ASHTON—[Now].

COST . . per Head weekly . . 3s. 2½d.
INCOME, 3s. 6d., 5 Dinners, 7½d., Total, 4s. 1½d.
CARBON . per Head daily . . . grains.
NITROGEN per Head daily . . . grains.
FAMILY, 1 Female.

(*Same person as No. 31.*)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	1½	- -	0 2		
Flour and yeast lb.	6	0 2	1 0	19,352	905
Flour, reckoned as bread - lb.	8⅓	- -	- -		
Oatmeal.					
Peas.					
Rice.					
Potatoes.					
Onions - - lb.	2	0 0¾	0 1½	840	42
Turnips.					
Sugar - - lb.	1	0 4½	0 4½	2,768	
Treacle.					
Butter - - lb.	¼	0 10	0 2½	1,058	
Lard.					
Dripping.					
Suet.					
Bacon, eats a little every day lb.	½	0 5	0 2½	2,139	39
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese - - lb.	½	0 5	0 2½	1,328	158
Tea - - oz.	2	0 1¾	0 3½	- -	20
Coffee.					
Chicory.					
Dinner, soup, &c.	5	0 1½	0 7½		
TOTAL - -	- -	- -	3 2½		

TABLE No. 33.

ASHTON—[ORDINARILY].

COST . . per Head weekly . . 6s. 6d.
INCOME . . . . 10s.
CARBON . per Head daily . . . 7,330 grains.
NITROGEN per Head daily . . . 290 grains.
FAMILY, 1 Female.

(*Same person as No. 34.*)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread.					
Flour and yeast lb.	9	0 2	1 7½		
Flour, reckoned as bread - lb.	12½	- -	- -	24,600	1,150
Oatmeal - lb.	1¼	0 2	0 2½	3,460	175
Peas.					
Rice.					
Potatoes, with dinner - lb.	5				
Onions.					
Turnips.					
Sugar - - lb.	¾	0 6	0 4½	2,076	
Treacle - - lb.	½	0 3	0 1½	1,120	
Butter - - lb.	½	1 0	0 6	2,352	
Lard - - oz.	2	0 8	0 1	588	
Dripping.					
Suet.					
Bacon.					
Meat, with dinner - - lb.	1½	- -	- -	3,870	240
Meat, reckoned without bone.					
Herrings - -	2	0 0½	0 1	538	82
Milk, new - pint	⅔	- -	0 1	364	28
,, skimmed.					
Butter milk.					
Cheese - - lb.	¼	0 8	0 2	664	79
Tea - - oz.	2	0 3½	0 7	- -	20
Coffee.					
Chicory.					
Fish, soles - lb.	2	0 6	1 0	1,680	256
Dinners, meat and potatoes -	7	0 3	1 9		
TOTAL - -	- -	- -	6 6	41,312	2,030

TABLE No. 34.

ASHTON—[Now].

COST . . per Head weekly . . 2s. 10d.
INCOME 3s. 6d., 5 Dinners 7½d., Total 4s. 1½d.
CARBON . per Head daily . . . grains.
NITROGEN per Head daily . . . grains.
FAMILY, 1 Female, aged 39.

(*Same person as No. 33.*)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread.					
Flour and yeast lb.	6	0 2	1 1		
Flour, reckoned as bread - lb.	8⅓	- -	- -	16,400	767
Oatmeal - lb.	1¼	0 1¾	0 2½	3,460	175
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	¼	0 6	0 1½	692	
Treacle - - lb.	½	0 3	0 1½	1,120	
Butter - - lb.	¼	1 0	0 3	1,176	
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat.					
Meat, reckoned without bone.					
Herrings - -	2	0 0½	0 1	438	82
Milk, new - pint	⅓	- -	0 0½	182	14
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3½	0 3½	- -	10
Coffee.					
Chicory.					
Dinners of soup, &c. - - -	5	0 1½	0 7½		
TOTAL - -	- -	- -	2 10		

APPENDIX.
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APPENDIX.
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TABLE No. 35.

ASHTON—[NOW].

COST . . per Head weekly . . 2*s*.
INCOME . . . . . weekly . . 3*s*.
CARBON . per Head daily . . . 2,963 grains.
NITROGEN per Head daily . . . 164 grains.
FAMILY, 1 Female.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	6	0 1½	0 9	11,808	552
Flour, reckoned as bread.					
Oatmeal - lb.	1	0 2	0 2	2,768	140
Peas,					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	½	0 6	0 3	1,384	
Treacle.					
Butter.					
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	¼	0 8	0 2	1,188	24
Meat.					
Meat, reckoned without bone.					
Herrings - -	4	- -	0 2	1,076	164
Milk, new.					
,, skimmed.					
Butter milk, pints	6	½	0 3	2,520	258
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	10
Coffee.					
Chicory.					
TOTAL -	- -	- -	2 0	20,744	1,148

TABLE No. 36.

STOCKPORT—[ORDINARILY].

COST . . per Head weekly . . 4*s*. 3*d*.
INCOME . . . . . weekly . . 10*s*.
CARBON . per Head daily . . . 5,487 grains.
NITROGEN per Head daily . . . 197 grains.
FAMILY, 1 Female, aged 20.

(*Same person as No.* 37.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	12	0 1½	1 6	23,616	1,102
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	5	1*s*.20lbs.	0 3	3,500	120
Onions - - lb.	½	- -	½	210	10
Turnips.					
Sugar - - lb.	1	0 6	0 6	2,768	
Treacle - - lb.	½	0 3	0 1½	1,120	
Butter - - lb.	¾	1 0	0 9	3,528	
Lard.					
Dripping.					
Suet.					
Bacon on 4 days lb.	½	0 8	0 4	4,376	48
Meat, Sunday and Monday - lb.	½	0 8	0 4	1,290	80
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	10
Coffee - - oz.	1	0 1	0 1	- -	5
Chicory.					
TOTAL -	- -	- -	4 3	38,408	1,375

TABLE No. 37.

STOCKPORT—[NOW].

COST . . per Head weekly . . 1*s*. 10*d*.
INCOME . . . . . weekly . . 3*s*. 2½*d*.
CARBON . per Head daily . . . 3,351 grains.
NITROGEN per Head daily . . . 136 grains.
FAMILY, 1 Female, aged 20.

(*Same person as No.* 36.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	1½	- -	0 2½	4,152	210
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	1,384	
Treacle - - lb.	½	- -	0 1½	1,120	
Butter - - lb.	¼	0 8	0 2	1,058	
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	½	0 3	0 1½	- -	5
Coffee.					
Chicory.					
TOTAL -	- -	- -	1 10	23,458	951

TABLE No. 38.

STOCKPORT—[ORDINARILY].

COST . . per Head weekly . . 3s. 4d.
INCOME . . . . . weekly . . 13s.
CARBON . per Head daily . . . 5,414 grains.
NITROGEN per Head daily . . . 193 grains.
FAMILY, 1 Female, aged 18.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread.					
Flour - lb.	6	0 2	1 0		
Flour, reckoned as bread - lb.	8⅓	- -	- -	16,400	767
Oatmeal - lb.	2	0 2	0 4	5,536	280
Peas.					
Rice.					
Potatoes - lb.	10	1s.20lbs.	0 6	7,600	240
Onions.					
Turnips.					
Sugar - - lb.	½	0 6	0 3	1,384	
Treacle - - lb.	1	0 3	0 3	2,240	
Butter - - lb.	½	1 0	0 6	2,352	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 6	0 3	2,376	48
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	½	0 3	0 1½	- -	5
Coffee - - oz.	2	0 0¾	0 1½	-	10
Chicory.					
TOTAL -	- -	- -	3 4	37,900	1,350

TABLE No. 39.

STOCKPORT—[NOW].

COST . . per Head weekly . . 2s. 10d.
INCOME . . . . . weekly . . 4s.
CARBON . per Head daily . . . 5,227 grains.
NITROGEN per Head daily . . . 227 grains.
FAMILY, 1 Female.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	12	0 1½	1 6	23,616	1,102
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	3	0 2	0 6	8,304	420
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar.					
Treacle - - lb.	1	0 2	0 2	2,240	
Butter - - lb.	¼	0 8	0 2	1,058	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 6	0 3	2,376	48
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
Milk, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	½	0 3	0 1½	- -	5
Coffee - - oz.	2	0 0¾	0 1½	- -	10
Chicory.					
TOTAL -	- -	- -	2 10	37,594	1,585

Has not taken fresh vegetables for 3 months.

TABLE No. 40.

STOCKPORT—[NOW].

COST . . per Head weekly . . 1s. 7¼d.
INCOME . . . . 2s.
CARBON . per Head daily . . . 3,405 grains.
NITROGEN per Head daily . . . 129 grains.
FAMILY, 1 Female, aged 16.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	6	- -	0 8½	11,808	552
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	2½	1/6 10 lb.	0 4½	6,920	350
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	¼	0 4	0 1	692	
Treacle - - lb.	1½	0 1½	0 2¼	3,360	
Butter - - lb.	¼	0 8	0 2	1,058	
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea.					
Coffee - - oz.	1	0 1	0 1	- -	5
Chicory.					
TOTAL -	- -	- -	1 7¼	23,838	907

APPENDIX.
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on Famine.
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nics of diet.
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TABLE No. 42.

MANCHESTER—[ORDINARILY].

COST . . per Head weekly . . 5*s.* 10½*d.*
WAGES . . . . . weekly . . 30*s.*
CARBON . per Head daily . . . 6,560 grains.
NITROGEN per Head daily . . . 275 grains.
FAMILY, 2; Man and Wife, aged.
(*Same family as No.* 43.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread - - lb.	14	0 1½	1 9	13,776	644
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	1¾	0 2	0 3½	2,472	122
Peas.					
Rice.					
Potatoes - lb.	35	1*s.* 20lbs.	1 9	13,300	420
Onions.					
Turnips.					
Sugar - - lb.	1½	0 5	0 7½	2,076	
Treacle.					
Butter - - lb.	1	1 0	1 0	2,352	
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat - - lb.	7	0 7	4 1	8,127	504
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings.					
Milk, new - pints	14	0 1½	1 9	3,822	150
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	5
Coffee - - oz.	3	0 1	0 3	- -	8
Chicory.					
TOTAL -	- -	- -	11 9	45,925	1,853

TABLE No. 43.

MANCHESTER—[NOW].

COST . . per Head weekly . . 2*s.* 0¾*d.*
INCOME . . . . . weekly . . 3*s.*
CARBON . per Head daily . . . 3,072 grains.
NITROGEN per Head daily . . . 120 grains.
FAMILY, 2 ; Man and Wife, aged.
(*Same family as No.* 42.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread - - lb.	10½	0 1½	1 3¾	10,332	493
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	3½	0 2	0 7	4,844	245
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	1½	0 5	0 7½	2,076	
Treacle.					
Butter.					
Lard.					
Dripping - lb.	½	0 4	0 2	1,330	
Suet.					
Bacon - - lb.	1	0 8	0 8	2,376	48
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new - pints	2	0 1½	0 3	546	43
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	5
Coffee - - oz.	3	0 1	0 3	- -	8
Chicory.					
TOTAL -	- -	- -	4 1¾	21,504	842

TABLE No. 44.

ASHTON—[NOW].

COST . . per Head weekly . . 1*s.* 9½*d.*
INCOME . . . . . weekly . . 4*s.* 4*d.*
CARBON . per Head daily . . . 3,188 grains.
NITROGEN per Head daily . . . 128 grains.
FAMILY, 2; Man and Wife.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	12	1/8 doz.	1 9½		
Flour, reckoned as bread - lb.	16¾	- -	- -	16,422	770
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	5	1/2 20lb.	0 3½	1,750	60
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	692	
Treacle - lb.	½	0 3	0 1½	560	
Butter - - lb.	½	0 10	0 5	1,058	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 6	0 3	1,188	24
Meat - - lb.	½	0 4	0 2	645	40
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1	0 2	0 2	- -	5
Coffee.					
Chicory.					
TOTAL -	- -	- -	3 5½	22,315	899

TABLE No. 45.

ASHTON—[NOW].

COST . . per Head weekly . . 3*s.*
INCOME . . . . . weekly . . 6*s.* 6*d.*
CARBON . per Head daily . . . 4,389 grains.
NITROGEN per Head daily . . . 173 grains.
FAMILY, 2 ; Man and Wife.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.					
Flour and yeast lb.	15	- -	2 5½		
Flour, reckoned as bread - lb.	21	- -	- -	20,664	966
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	10	1/2 20lb.	0 7	3,500	120
Onions.					
Turnips.					
Sugar - - lb.	1	0 6	0 6	1,384	
Treacle.					
Butter - - lb.	1	1 0	1 0	2,352	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	1	0 5	0 5	2,129	39
Meat - - lb.	1	0 7	0 7	1,290	80
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
„ skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	2	- -	0 5½	- -	10
Coffee.					
Chicory.					
TOTAL - -	- -	- -	6 0	31,329	1,215

TABLE No. 46.

ASHTON—[NOW].

COST . . per Head weekly . . 2*s.* 1½*d.*
INCOME . . . . . weekly . . 8*s.* 6*d.*
CARBON . per Head daily . . . 3,051 grains.
NITROGEN per Head daily . . . 117 grains.
FAMILY, 3 Adults; Man, Wife, 1 Child, aged 19.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	15	0 1¾	2 5		
Flour, reckoned as bread -	21½	- -	- -	14,104	663
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	10	1/2 20lb.	0 7	2,533	80
Onions.					
Turnips.					
Sugar - - lb.	1	0 6	0 6	923	
Treacle.					
Butter - - lb.	1	1 0	1 0	1,568	
Lard.					
Dripping.					
Suet.					
Bacon - lb.	1	0 7	0 7	1,584	32
Meat - - lb.	¾	0 8	0 6	645	40
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
„ skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	2	0 3	0 6	-	7
Coffee.					
Chicory.					
TOTAL - -	- -	- -	6 4	21,357	822

TABLE No. 47.

MANCHESTER—[ORDINARILY].

COST . . per Head weekly . . 2*s.* 7¼*d.*
CARBON . per Head daily . . . 4,475 grains.
NITROGEN per Head daily . . . 193 grains.
FAMILY, 3 ; Self and 2 Children, aged 5 and 7.
(Husband deserted her.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	28	0 1½	3 6	18,368	858
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	4	0 2	0 8	3,691	187
Peas.					
Rice.					
Potatoes - lb.	17½	1*s.*20lbs.	0 10½	4,433	140
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	457	
Treacle - - lb.	1	0 2	0 2	746	
Butter - - lb.	¾	0 9	0 6¾	1,176	
Lard.					
Dripping - lb.	¼	0 8	0 2	443	
Suet.					
Beans.					
Meat - - lb.	1½	0 6	0 9	1,290	80
Meat, reckoned without bone.					
Herrings - -	2	0 0¾	0 1½	176	27
Milk, new.					
„ skimmed pint	3½	0 1	0 3½	544	50
Butter milk.					
Cheese.					
Tea - - oz.	1¼	0 3	0 4	- -	4
Coffee - - oz.	2	0 1	0 2	- -	3
Chicory.					
TOTAL - -	- -	- -	7 9¾	31,324	1,349

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Details of Dietaries.

Families.

TABLE No. 48.

MANCHESTER—[Now].

COST . . per Head weekly . . 1*s.* 8½*d.*
CARBON . per Head daily . . . 3,353 grains.
NITROGEN per Head daily . . . 138 grains.
FAMILY, 3; 2 young Children.

(*Same family as No.* 47.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	18	0 1½	2 3	11,808	552
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	4	0 2	0 8	3,691	187
Peas.					
Rice.					
Potatoes - lb.	5	1*s.* 20lbs.	0 3	4,433	140
Onions.					
Turnips.					
Sugar - - lb.	½	0 5	0 2½	457	
Treacle - - lb.	1	0 2	0 2	746	
Butter - - lb.	¾	0 9	0 6¾	1,176	
Lard.					
Dripping - lb.	¼	0 8	0 2	443	
Suet.					
Bacon.					
Meat.					
Meat, reckoned without bone.					
Herrings - -	2	0 0¾	0 1½	176	27
Milk, new.					
,, skimmed pints	3½	0 1	0 3½	544	50
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	3
Coffee - - oz.	2	0 1	0 2	- -	3
Chicory.					
TOTAL -	- -	- -	5 1½	23,474	962

TABLE No. 49.

ASHTON—[Now].

{ COST . . per Head weekly . . 2*s.*
{ INCOME . . . . . weekly . . 10*s.*
CARBON . per Head daily . . . 3,288 grains.
NITROGEN per Head daily . . . 137 grains.
FAMILY, 4; Man, Wife, 2 Children, aged 2 to 9.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	18	0 2	3 3		
Flour, reckoned as bread lb.	25¼	- -	- -	12,423	581
Oatmeal - lb.	5	1/4 10 lb.	0 8	3,460	175
Peas.					
Rice.					
Potatoes - lb.	10	1/2 20 lb.	0 7	1,900	60
Onions - - lb.	2	0 0¾	0 1½	105	5
Turnips.					
Sugar - - lb.	1½	0 6	0 9	1,038	
Treacle - - lb.	2	0 2	0 4	560	
Butter - - lb.	1	1 0	1 0	1,176	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	1	0 7	0 7	1,188	24
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new - pints	$6\frac{1}{10}$	0 1¼	0 8	833	66
,, skimmed.					
Butter milk.					
Cheese - - lb.	½	0 6	0 3	332	39
Tea - - oz.	2	0 3	0 6	- -	5
Coffee - - oz.	2	0 0¾	0 1½	- -	3
Chicory.					
TOTAL -	- -	- -	8 0	23,015	958

TABLE No. 50.

ASHTON—[Now].

{ COST . . per Head weekly . . 2*s.* 3*d.*
{ INCOME . . . . . weekly . . 10*s.*
CARBON . per Head daily . . . 3,809 grains.
NITROGEN per Head daily . . . 155 grains.
FAMILY, 4; Man, Wife, 2 Children, aged 21 and 15 (Adults).

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	24	0 2	4 4		
Flour, reckoned as bread lb.	33½	- -	- -	16,482	770
Oatmeal - - lb.	5	1/2 10 lb.	0 7	3,460	175
Peas.					
Rice.					
Potatoes - lb.	10	1*s.* score	0 6	1,900	60
Onions.					
Turnips.					
Sugar - - lb.	1½	0 5	0 7½	1,038	
Treacle - - lb.	1	0 2	0 2	560	
Butter - - lb.	1½	0 11	1 4½	1,588	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 8	0 4	594	12
Meat - - lb.	1½	0 7	0 10½	967	50
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	3
Coffee - - oz.	2	0 1¼	0 2½	- -	2
Chicory.					
Liver - - lb.	¼	- -	0 1	76	16
TOTAL -	- -	- -	9 0	26,665	1,088

TABLE No. 51.

ASHTON—[NOW].

COST . . per Head weekly . . 2s. 6½d.
INCOME . . . . 9s. 1d.
CARBON . per Head daily . . . 3,459 grains.
NITROGEN per Head daily . . . 147 grains.
FAMILY, 4; Man, Wife, 2 Children, aged 8 and 11.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread.					
Flour and yeast lb.	18	0 1½	3 2½		
Flour, reckoned as bread - lb.	25¼	- -	- -	12,423	581
Oatmeal - lb.	2½	1/4 10lb.	0 4	1,730	88
Peas - - lb.	1	0 2	0 2	672	63
Rice.					
Potatoes - lb.	10	1/0 20lb.	0 6	1,900	60
Onions - - lb.	2	0 0¾	0 1½	210	11
Turnips.					
Sugar - - lb.	1½	0 6	0 9	1,038	
Treacle - - lb.	1	0 2	0 2	560	
Butter - - lb.	1	1 0	1 0	1,176	
Lard - - lb.	¼	0 8	0 2	332	
Dripping.					
Suet - - oz.	2	0 0½	0 1	197	
Bacon - - lb.	1	0 8	0 8	1,188	24
Meat - - lb.	1½	0 6	0 9	967	50
Meat, reckoned without bone.					
Herrings - -	3	0 0½	0 1½	202	31
Milk, new - pints	7	0 1¼	0 8¾	955	
,, skimmed.					
Butter milk.					
Cheese - - lb.	1	0 6	0 6	664	79
Tea - - oz.	2	0 3	0 6	- -	5
Coffee - - } oz. Chicory - - }	2	0 0¾	0 1½	- -	2
Cockles - - -	- -	- -	0 3		
TOTAL -	- -	- -	10 1¾	24,214	1,031

TABLE No. 52.

ASHTON—[NOW].

COST . . per Head weekly . . 1s. 8d.
INCOME . . . . 9s. 8d.
CARBON . per Head daily . . . 3,333 grains.
NITROGEN per Head daily . . . 154 grains.
FAMILY, 5; Man, Wife, 3 Children, aged 6, 3, and ¾ years.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread.					
Flour and yeast lb.	24	1/9 doz.	3 11		
Flour, reckoned as bread - lb.	33½	- -	- -	13,186	616
Oatmeal - lb.	10	1/4 10lb.	1 4	5,536	280
Peas.					
Rice.					
Potatoes - lb.	5	1/2 20lb.	0 3½	760	24
Onions - - lb.	2	0 0¾	0 1½	168	8
Turnips.					
Sugar - - lb.	1	0 5	0 5	553	28
Treacle - - lb.	3	0 2	0 6	1,344	
Butter - - lb.	½	1 0	0 6	488	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 7	0 3½	475	9
Meat.					
Meat, reckoned without bone.					
Herrings - -	9	- -	0 3	484	74
Milk, new.					
,, skimmed.					
Butter milk pints	4	0 0½	0 2	336	34
Cheese.					
Tea - - oz.	2	0 3	0 6	- -	4
Coffee.					
Chicory.					
TOTAL -	- -	- -	8 3½	23,330	1,077

TABLE No. 53.

ASHTON—[ORDINARILY].

COST . . per Head weekly . . 3s.
INCOME . . . . 42s.
CARBON . per Head daily . . . 3,839 grains.
NITROGEN per Head daily . . . 141 grains.
FAMILY, 5; Man, Wife, 3 Children, aged 13 to 19; nearly Adults.

(*Same family as No. 54.*)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread.					
Flour and yeast lb.	27	0 2	4 9		
Flour, reckoned as bread - lb.	37¾	- -	- -	14,834	694
Oatmeal - lb.	2½	1/4 10lb.	0 4	1,384	70
Peas.					
Rice.					
Potatoes - lb.	15	1/0 20lb.	0 9	2,280	72
Onions - - lb.	2	0 1	0 2	168	8
Turnips - lb.	3	0 0½	0 1½	104	7
Sugar - - lb.	4	0 5	1 8	2,415	
Treacle - - lb.	2	0 2	0 4	896	
Butter - - lb.	2	1 0	2 0	1,881	
Lard - - lb.	½	0 8	0 4	532	
Dripping.					
Suet.					
Bacon - - lb.	¼	0 8	0 2	257	5
Meat - - lb.	4	0 7½	2 6	1,858	115
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese - - lb.	½	0 7	0 3½	265	31
Tea - - lb.	¼	4 4	1 1	- -	8
Coffee - - lb.	¼	1 8	0 5	- -	4
Chicory - lb.	¼	0 4	0 1	- -	
TOTAL -	- -	- -	15 0	26,874	984

TABLE No. 54.

ASHTON—[Now].

COST . . per Head weekly . . 2*s.* 10*d.*
INCOME . . . . . weekly . . 14*s.* 7*d.*
CARBON . per Head daily . . . 3,793 grains.
NITROGEN per Head daily . . . 143 grains.
FAMILY, 5.

(*Same family as No.* 53.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	27	0 2	4 9	14,834	694
Flour, reckoned as bread - lb.	37¾	- -	- -		
Oatmeal - lb.	2½	1/4 10lb.	0 4	1,384	70
Peas.					
Rice.					
Potatoes - lb.	15	1/0 20lb.	0 9	2,280	72
Onions - lb.	2	0 1	0 2	168	8
Turnips - lb.	3	- -	0 1½	104	7
Sugar - lb.	3	0 5	1 3	1,661	
Treacle - lb.	3	0 2	0 6	1,344	
Butter - lb.	1½	1 0	1 6	1,411	
Lard - - lb.	½	0 8	0 4	532	
Dripping.					
Suet.					
Bacon - - lb.	¾	0 8	0 6	713	14
Meat - - lb.	4	0 7½	2 6	1,858	100
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese - - lb.	½	0 7	0 3½	265	31
Tea - - oz.	2	0 3¼	0 6½	- -	4
Coffee - - lb.	¼	1 8	0 5	- -	4
Chicory - lb.	¼	0 . 4	0 1		
TOTAL -	- -	- -	14 0½	26,555	1,004

TABLE No. 55.

BLACKBURN—[Now].

COST . . per Head weekly . . 1*s.* 0¼*d.*
INCOME . . . . . weekly . . 10*s.*
CARBON . per Head daily . . . 2,200 grains.
NITROGEN per Head daily . . . 92 grains.
FAMILY, 5; Man, Wife, 3 Children, aged 23 to 17, all Adults.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	6	0 1½	0 9	6,789	322
Flour - - lb.	8	0 1½	1 0		
Flour, reckoned as bread - lb.	11¼	- -	- -		
Oatmeal - lb.	8	0 1½	1 0	4,409	224
Peas.					
Rice.					
Potatoes (for Sunday) - lb.	10	1/1 20lb.	0 6½	1,520	48
Onions.					
Turnips.					
Sugar - - lb.	1½	0 4	0 6	830	
Treacle - - lb.	1	0 2	0 2	448	
Butter - - lb.	1	0 8	0 8	847	
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat.					
Meat, reckoned without bone.					
Herrings - -	2	0 0½	0 1	107	16
Milk, new.					
,, skimmed pint	4	0 0½	0 2	350	32
Butter milk.					
Cheese.					
Tea - - oz.	½	0 3	0 1½	- -	1
Coffee - - oz.	2	0 0¾	0 1½	- -	2
Chicory.					
TOTAL -	- -	- -	5 1½	15,400	645

Soup, less than 1 quart per week. Makes oat-cakes.

TABLE No. 56.

PRESTON—[Now].

COST . . per Head weekly . . 2*s.* 3½*d.*
CARBON . per Head daily . . . 3,549 grains.
NITROGEN per Head daily . . . 153 grains.
FAMILY, 5 ; Widow, 4 Children, aged 24 to 7.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	42	0 1½	5 3	16,531	772
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	3½	- -	0 6	1,933	98
Peas.					
Rice.					
Potatoes - lb.	10	1/1 20lb.	0 6½	1,520	48
Onions.					
Turnips.					
Sugar - - lb.	1½	0 5½	0 8¼	830	
Treacle - - lb.	1	0 2	0 2	448	
Butter - - lb.	1	1 2	1 2	941	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	1	0 8	0 8	950	19
Meat - - lb.	1	0 8	0 8	516	32
Meat, reckoned without bone.					
Herrings - -	8	0 0½	0 4	429	65
Milk, new pints	7	0 1½	0 10½	764	30
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3½	0 3½	- -	2
Coffee - - oz.	4	1*s.* lb.	0 3	- -	4
Chicory.					
TOTAL -	- -	- -	11 4¾	24,842	1,070

TABLE No. 57.

PRESTON—[Now].

COST . . per Head weekly . . 1*s.* 4¾*d.*
INCOME . . . . . weekly . . 8*s.*
CARBON . per Head daily . . . grains.
NITROGEN per Head daily . . . grains.
FAMILY, 5; Man, Wife, 3 Children, eldest aged 15.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	26	0 1½	3 3	10,236	478
Flour.					
Flour, reckoned as bread.					
Oatmeal - - lb.	2	0 1½	0 3	1,107	56
Peas.					
Rice.					
Potatoes - - lb.	5	1*s.*20lbs.	0 3	700	24
Onions.					
Turnips.					
Sugar - - lb.	1	0 4	0 4	553	
Treacle - - lb.	2	0 2	0 4	896	
Butter - - lb.	½	1 0	0 6	470	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 8	0 4	475	9
Meat - - lb.	½	0 8	0 4	258	16
Meat, reckoned without bone.					
Herrings, red -	3	0 0½	0 1½	161	24
Milk, new - pints	⅔	- -	0 1	73	5
„ skimmed.					
Butter milk.					
Cheese.					
Tea - - - oz.	1	0 3	0 3	- -	2
Coffee.					
Chicory.					
Soups - pints	12	0 0¾	0 9		
TOTAL - -	- -	- -	6 9½		

TABLE No. 58.

ASHTON—[Now].

COST . . per Head weekly . . 1*s.* 9½*d.*
INCOME . . . . . weekly . . 12*s.*
CARBON . per Head daily . . . 3,193 grains.
NITROGEN per Head daily . . . 180 grains.
FAMILY, 6; Man, Wife, 4 Children, aged 19, 17, 14, and 5.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	24	1/9 doz.	3 10		
Flour, reckoned as bread - lb.	33½	- -	- -	10,988	514
Oatmeal - - lb.	25	1/6 10lb.	3 4	11,533	583
Peas.					
Rice.					
Potatoes - - lb.	20	1/2 score	1 2	2,533	80
Onions.					
Turnips.					
Sugar.					
Treacle.					
Butter - - lb.	½	1 0	0 6	392	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	2	0 4	0 8	1,584	26
Meat.					
Meat, reckoned without bone.					
Herrings - -	8	0 0½	0 4	358	56
Milk, new.					
„ skimmed.					
Butter milk.					
Cheese.					
Tea - - - oz.	2	0 2	0 4	- -	3
Coffee - - oz.	2	0 0¾	0 1½	- -	2
Chicory.					
TOTAL - -	- -	- -	10 9	27,388	1,264

TABLE No. 59.

—[Now].

COST . . per Head weekly . .
INCOME . . . . . weekly . . 14*s.* 6*d.*
CARBON . per Head daily . . . 2,915 grains.
NITROGEN per Head daily . . . 111 grains.
FAMILY, 6; Man, Wife, 4 Children, aged 14, 11, 4, and ¾.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	30	1/9 doz.	4 9½	13,776	644
Flour reckoned, as bread - lb.	42				
Oatmeal.					
Peas.					
Rice.					
Potatoes - - lb.	20	1/2 score	1 2	2,533	80
Onions.					
Turnips.					
Sugar - - lb.	2½	0 5	1 0½	1,153	
Treacle - - lb.	2	0 2	0 4	746	
Butter - - lb.	1½	0 1	1 6	1,176	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	1	0 6	0 6	792	16
Meat - - lb.	1½	0 6	0 9	645	33
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
Milk. skimmed					
Butter milk.					
Cheese.					
Tea - - - oz.	2	0 3	0 6	- -	3
Coffee - - oz.	2	0 1¼	0 2½	- -	2
Chicory.					
TOTAL - -	- -	- -	10 9½	20,621	778

TABLE No. 60.

ASHTON—[NOW].

COST . . per Head weekly . . 1*s.* 6*d.*
INCOME . . . . 14*s.* 6*d.*
CARBON . per Head daily . . . 2,275 grains.
NITROGEN per Head daily . . . 85 grains.
FAMILY, 6 ; Man, Wife, and 4 Children, aged 9, 7, 4, and 2.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	18	0 2	3 3		
Flour, reckoned as bread - lb.	25¼	- -	- -	8,282	387
Oatmeal - lb.	2½	1/8 peck	0 5	1,153	58
Peas.					
Rice.					
Potatoes - lb.	20	1/2 20 lb.	1 2	2,533	80
Onions.					
Turnips.					
Sugar - - lb.	2	0 5½	0 11	923	
Treacle - lb.	2	0 2	0 4	746	
Butter - - lb.	¾	1 0	0 9	588	
Lard					
Dripping.					
Suet.					
Bacon - - lb.	1½	0 8	1 0	1,188	24
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new - pints	6	0 1	0 6	546	43
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	2	0 3¼	0 6½	- -	3
Coffee - - oz.	2	0 1¼	0 2½	- -	2
Chicory.					
TOTAL - -	- -	- -	9 1	15,959	597

TABLE No. 61.

ASHTON—[ORDINARILY].

COST . . per Head weekly . . 2*s.* 10¾*d.*
INCOME . . . . 28*s.*
CARBON . per Head daily . . . 3,590 grains.
NITROGEN per Head daily . . . 144 grains.
FAMILY, 6 ; Man, Wife, 4 Children, aged 18 to 4 months.

(*Same family as No. 62.*)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	27	0 1¾	4 4		
Flour, reckoned as bread - lb.	37¾	- -	- -	12,362	578
Oatmeal - lb.	2½	1/6 10 lb.	0 4½	1,154	58
Peas - - lb.	1	0 1½	0 1½	448	42
Rice - - lb.	1	0 4	0 4	448	12
Potatoes - lb.	20	1/1 20 lb.	1 1	2,533	80
Onions - - lb.	3	0 0½	0 1½	210	10
Turnips.					
Sugar - - lb.	3	0 5½	1 4½	1,384	
Treacle - - lb.	1	0 2	0 2	373	
Butter - - lb.	3	1 0	3 0	2,352	
Lard - - lb.	½	0 8	0 4	443	
Dripping.					
Suet.					
Bacon - - lb.	1	0 8	0 8	792	16
Meat - - lb.	3¾	0 8	2 6	1,451	78
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings - -	4	0 0½	0 2	179	27
Milk, new - pints	7	0 1¼	0 8¾	637	25
,, skimmed.					
Butter milk.					
Cheese - - lb.	1½	0 8	1 0	664	79
Tea - - oz.	3	0 3¼	0 10½	- -	5
Coffee - - oz.	2	0 1	0 2	- -	2
Chicory.					
TOTAL - -	- -	- -	17 4¼	25,130	1,012

TABLE No. 62.

ASHTON—[NOW].

COST . . per Head weekly . . 1*s.* 8½*d.*
CARBON . per Head daily . . . 2,808 grains.
NITROGEN per Head daily . . . 115 grains.
FAMILY, 6.

(*Same family as No. 61.*)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	24	0 1¾	3 6		
Flour, reckoned as bread - lb.	33½	- -	- -	10,988	513
Oatmeal - lb.	5	1/6 10 lb.	0 9	2,307	117
Peas - - lb.	2	0 1½	0 3	896	84
Rice - - lb.	⅓	0 3	0 1	149	4
Potatoes - lb.	5	1/1 20 lb.	0 3¼	583	20
Onions - - lb.	3	- -	0 1	210	11
Turnips.					
Sugar - - lb.	2	0 5	0 10	922	
Treacle - - lb.	3	0 2	0 6	1,120	
Butter - - lb.	1½	1 0	1 6	1,176	
Lard - - oz.	2	8*d.* lb.	0 1	111	
Dripping.					
Suet.					
Bacon - - lb.	½	0 8	0 4	396	8
Meat - - lb.	1½	0 7	0 10½	645	33
Meat, reckoned without bone.					
Herrings.					
Milk, new - pints	1¾	- -	0 3½	158	
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	2	0 3	0 6	- -	3
Coffee - - oz.	2	0 1	0 2	- -	2
Chicory.					
TOTAL - -	- -	- -	10 3¾	19,661	807

Table No. 63.

WIGAN—[Ordinarily].

Cost . . per Head weekly . . 5*s.* 1*d.*
Income . . . . 40*s.*
Carbon . per Head daily . . . 6,369 grains.
Nitrogen per Head daily . . . 259 grains.
Family, 6 ; Man, Wife, 4 Children ; 5 Adults.

(*Same family as No. 64.*)

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	68	0 1½	8 6	22,304	1,042
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	3	0 2	0 6	1,384	70
Peas - - lb.	¾	- -	0 2	336	44
Rice.					
Potatoes - lb.	56	1*s.*20lbs.	2 9½	7,093	224
Onions.					
Turnips.					
Sugar - - lb.	4	0 5	1 8	1,845	
Treacle - - lb.	1	0 2½	0 2½	373	
Butter - - lb.	4	0 11	3 8	2,822	
Lard - } Dripping - } lb.	1	0 8	0 8	886	
Suet.					
Bacon - - lb.	1	0 8	0 8	692	16
Meat - - lb.	14	0 7	8 2	5,418	336
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings - -	4	- -	0 3	178	27
Milk, new - pints	14	0 1½	1 9	1,274	50
„ skimmed.					
Butter milk.					
Cheese - - lb.	1½	0 6	0 9		
Tea - - oz.	2	0 3	0 6	- -	3
Coffee - - lb.	¼	1 4	0 4	- -	2
Chicory.					
Total -	- -	- -	30 7	44,585	1,815

Table No. 64.

WIGAN—[Now].

Cost . . per Head weekly . . 2*s.* 3*d.*
Income . . . . 15*s.*
Carbon . per Head daily . . . grains.
Nitrogen per Head daily . . . grains.
Family, 6 ; 5 Adults.

(*Same family as No. 63.*)

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	15,744	736
Flour - - lb.	24	0 2	4 0		
Flour, reckoned as bread - lb.	32½	- -	- -		
Oatmeal - lb.	3	- -	0 5½	1,384	70
Peas.					
Rice.					
Potatoes - lb.	10	1*s.*20lbs.	0 6	1,266	40
Onions.					
Turnips.					
Sugar - - lb.	2	0 5	0 10	922	
Treacle - - lb.	1	0 2½	0 2½	373	
Butter - - lb.	1½	0 8	1 0	1,058	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	2	0 5	0 10	1,584	32
Meat - - lb.	1	0 7	0 7	430	26
Meat, reckonec without bone.					
Herrings (red) -	4	- -	0 3	178	27
Milk, new - pints	14	0 1½	1 9	1,274	50
„ skimmed.					
Butter milk.					
Cheese - - lb.	½	0 5	0 2½	221	26
Tea - - oz.	3	0 3	0 9	- -	5
Coffee - - lb.	¼	1 4	0 4	- -	3
Chicory.					
Cabbage - lb.	3	- -	0 1½	210	8
Soup (Eckersley) pints	18	0 0¾	1 1½		
Total -	- -	- -	13 5½		

Table No. 65.

ASHTON—[Now].

Cost . . per Head weekly . . 1*s.* 7¾*d.*
Income . . . . 16*s.* 6*d.*
Carbon . per Head daily . . . 2,792 grains.
Nitrogen per Head daily . . . 111 grains.
Family, 7 ; Man, Wife, 5 Children, aged 11, 9, 7, 3, and ¾ years.

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour - - lb.	36	1/10 doz.	5 11	14,151	661
Flour, reckoned as bread - lb.	50¾	- -	- -		
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	15	1*s.*20lbs.	0 9	1,628	51
Onions.					
Turnips.					
Sugar - - lb.	2	0 5	0 10	791	
Treacle - - lb.	2	0 2	0 4	640	
Butter - - lb.	1½	1 0	1 6	1,008	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	1	0 8	0 8	679	13
Meat - - lb.	½	0 7	0 3½	184	11
Meat, reckoned without bone.					
Herrings.					
Milk, new - pints	6	0 1	0 6	468	37
„ skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	2	0 3½	0 7	- -	3
Coffee - - oz.	2	0 1¼	0 2½	- -	2
Chicory.					
Total -	- -	- -	11 2	19,547	778

Appendix.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Details of Dietaries.

Families.

TABLE No. 66.

ASHTON—[Now].

COST . . per Head weekly . . 2*s*.
INCOME . . . . . weekly . . 16*s*. 6*d*.
CARBON . per Head daily . . . 2,849 grains.
NITROGEN per Head daily . . . 113 grains.
FAMILY, 7; Man, Wife, 5 Children, aged 16, 10, 8, 4, and ¾.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	36	0 2	6 5		
Flour, reckoned as bread - lb.	50⅓	- -	- -	14,153	662
Oatmeal - - lb.	2½	- -	0 4½	988	50
Peas - - lb.	1	0 2	0 2	384	36
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	2½	0 5	1 0½	988	
Treacle - lb.	3	0 2	0 6	960	
Butter - - lb.	2	1 0	2 0	1,344	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	1	0 6	0 6	679	7
Meat - - lb.	1½	0 6	0 9	553	29
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
„ skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	2	0 3½	0 7	- -	3
Coffee - - lb.	¼	1 8	0 5	- -	3
Chicory.					
TOTAL - -	- -	- -	14 0	19,949	790

TABLE No. 67.

MANCHESTER—[Now].

COST . . per Head weekly . . 9¼*d*.
CARBON . per Head daily . . . grains.
NITROGEN per Head daily . . . grains.
FAMILY, 7; Wife, 6 young Children. (Father lives apart.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains,
Bread - - lb.	28	0 1½	2 3		
Flour - - lb.	1	0 2	0 2	8,265	386
Flour, reckoned as bread lb.	1⅓	- -	- -		
Oatmeal - lb.	5	0 2	0 10	1,961	100
Peas.					
Rice.					
Potatoes.					
Onions.					
Turnips.					
Sugar.					
Treacle - lb.	1¾	0 2	0 3½	418	
Butter.					
Lard.					
Dripping - lb.	1	0 8	0 8	760	
Suet.					
Bacon.					
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new - pints	2⅓	0 1½	0 3½	182	14
„ skimmed.					
Butter milk.					
Cheese.					
Tea.					
Coffee.					
Chicory.					
Soup - pints	14	0 0¾	0 10½		
TOTAL - -	- -	- -	5 4½		

TABLE No. 68.

MANCHESTER—[Now].

COST . . per Head weekly . . 1*s*. 4*d*.
CARBON . per Head daily . . . grains.
NITROGEN per Head daily . . . grains.
FAMILY, 7; Man, Wife, 5 young Children, eldest aged 8 years.

(*Same family as No.* 69.)

FOOD.	Quan. tity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
Bread - - lb.	28	*s.* *d.* 0 1½	*s.* *d.* 2 3	Grains. 7,872	Grains. 368
Flour.					
Flour, reckoned as bread.					
Oatmeal - lb.	14	0 2	2 4	5,250	280
Peas.					
Riee.					
Potatoes.					
Onions.					
Turnips.					
Sugar - - lb.	3	0 4	1 0	1,186	
Treacle - - lb.	3½	0 2	0 7	835	
Butter - - lb.	¼	1 0	0 3	168	
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
„ skimmed, pts.	28	0 0¾	1 9	1,752	172
Butter milk.					
Cheese.					
Tea - - oz.	3	0 3	0 9	- -	4
Coffee.					
Chicory.					
Soup - - pints	8	0 0¾	0 6		
TOTAL - -	- -	- -	9 5		

Table No. 69.

MANCHESTER—[Ordinarily].

Cost . . per Head weekly . . 2*s.* 6½*d.*
Carbon . per Head daily . . . 3,402 grains.
Nitrogen per Head daily . . . 151 grains.
Family, 7; young Children.

(*Same family as No.* 68.)

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread.					
Flour, yeast, salt, lb.	36	0 2	6 7	14,057	657
Flour, reckoned as bread - lb.	50	- -	- -		
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	42	1/2 20 lb.	2 5½	4,560	144
Onions.					
Turnips.					
Sugar - - lb.	3½	0 5	1 5½	1,384	
Treacle.					
Butter - - lb.	1¾	1 0	1 9	1,176	
Lard.					
Dripping.					
Suet - - lb.	½	0 8	0 4	336	
Bacon - - lb.	½	0 8	0 4	339	7
Meat - - lb.	5¼	0 6	2 7½	1,741	108
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	6	0 3	1 6	- -	8
Coffee.					
Chicory.					
Eggs - - -	15or18	- -	0 9	226	56
Total -	- -	- -	17 9½	23,819	1,060

Table No. 70.

ASHTON—[Now].

Cost . . per Head weekly . . 1*s.* 10½*d.*
Income . . . . . weekly . . 18*s.* 6*d.*
Carbon . per Head daily . . . 3,241 grains.
Nitrogen per Head daily . . . 134 grains.
Family, 8; Man, Wife, and 6 Children, aged 18, 16, 14, 11, 9, and 7.

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	36	1/8 12lb.	5 6	12,382	577
Flour, reckoned as bread - lb.	50⅓	- -	- -		
Oatmeal - lb.	10	1/6 10lb.	1 6	3,460	175
Peas.					
Rice.					
Potatoes - lb.	20	1/2 20lb.	1 2	1,900	60
Onions.					
Turnips.					
Sugar - - lb.	2	0 5	0 10	692	
Treacle - - lb.	3	0 2	0 6	840	
Butter - - lb.	2	1 0	2 0	1,176	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	2	0 6	1 0	1,188	24
Meat - - lb.	2	0 7	1 2	645	40
Meat, reckoned without bone.					
Herrings - -	12	- -	0 6	403	62
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea.					
Coffee - - oz.	4	0 1	0 4	- -	3
Chicory.					
Total -	- -	- -	15 0	22,686	941

Table No. 71.

ASHTON—[Now].

Cost . . per Head weekly . . 1*s.* 1¾*d.*
Income . . . . . weekly . . 12*s.*
Carbon . per Head daily . . . 2,071 grains.
Nitrogen per Head daily . . . 91 grains.
Family, 8; Man, Wife, 6 Children, aged 15, 11, 9, 7, 4, and ⅓ years.

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	30	- -	4 11	10,332	483
Flour, reckoned as bread - lb.	42	- -	- -		
Oatmeal - lb.	2½	1/8 10lb.	0 5	865	44
Peas.					
Rice.					
Potatoes - lb.	5	1/2 20lb.	0 3½	437	15
Onions - - lb.	2	0 0¾	0 1½	105	5
Turnips.					
Sugar - - lb.	1	0 6	0 6	343	
Treacle - - lb.	4	0 2	0 8	1,120	
Butter - - lb.	½	1 0	0 6	294	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	½	0 6	0 3	297	6
Meat.					
Meat, reckoned without bone.					
Herrings - -	12	- -	0 4	402	61
Milk, new pints	4	0 1¼	0 5	273	22
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	2	0 3	0 6	- -	2
Coffee - - oz.	4	0 0¾	0 3	- -	3
Chicory.					
Total -	- -	- -	9 1	14,498	641

Table No. 72.

STOCKPORT—[Ordinarily].

Cost . . per Head weekly . . 2s. 10d.
Income . . . . . weekly . . 50s.
Carbon . per Head daily . . . 3,962 grains.
Nitrogen per Head daily . . . 183 grains.
Family, 8 ; Man, 7 Children, aged 25 to 3 years.

Food.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread.					
Flour and yeast lb.	42	0 2	7 3	14,202	805
Flour, reckoned as bread - lb.	$58\frac{3}{4}$	- -	- -		
Oatmeal - lb.	5	1/6 10lb.	0 9	1,730	88
Peas.					
Rice.					
Potatoes - lb.	40	1s. 20lbs.	2 0	3,800	120
Onions - - lb.	2	0 1	0 2	105	5
Turnips.					
Sugar - - lb.	3	0 6	1 6	1,038	
Treacle - - lb.	3	0 2	0 6	840	
Butter - - lb.	3	1 0	3 0	1,764	
Lard - - lb.	$\frac{1}{2}$	0 8	0 4	332	
Dripping.					
Suet.					
Bacon - - lb.	1	0 8	0 8	594	12
Meat - - lb.	5	0 7	2 11	1,451	75
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings.					
Milk, new - pints	7	0 1	0 7	478	19
„ skimmed.					
Butter milk - pints	14	0 $0\frac{1}{2}$	0 7	735	75
Cheese - - lb.	2	0 6	1 0	664	79
Tea - - lb.	$\frac{1}{4}$	4 0	1 0	- -	5
Coffee - - lb.	$\frac{1}{4}$	1 4	0 4	- -	3
Chicory.					
Total -	- -	- -	22 7	27,733	1,286

Table No. 73.

BLACKBURN—[Now].

Cost . . per Head weekly . . 1s. $3\frac{3}{4}$d.
Income . . . . . weekly . . 17s.
Carbon . per Head daily . . . 2,818 grains.
Nitrogen per Head daily . . . 112 grains.
Family, 8 ; Man, Wife, 6 Children, aged 11 to 2.
(Young Children.)

Food.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	5	0 $1\frac{1}{2}$	0 $7\frac{1}{2}$	11,562	540
Flour - - lb.	30	0 $1\frac{1}{2}$	3 9		
Flour, reckoned as bread - lb.	42	- -	- -		
Oatmeal - lb.	4	0 $1\frac{1}{2}$	0 6	1,384	70
Peas.					
Rice.					
Potatoes - lb.	10	1/1 20lb.	0 $6\frac{1}{2}$	950	30
Onions.					
Turnips.					
Sugar - - lb.	$1\frac{1}{2}$	0 6	0 9	519	
Treacle - - lb.	1	0 2	0 2	280	
Butter - - lb.	$1\frac{1}{2}$	0 11	1 $4\frac{1}{2}$	794	
Lard - - lb.	$\frac{1}{2}$	0 6	0 3	332	
Dripping.					
Suet.					
Bacon - - lb.	$\frac{1}{2}$	0 6	0 3	297	6
Meat - - lb.	$1\frac{1}{2}$	6 6	0 9	484	25
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
„ skimmed pints	$17\frac{1}{2}$	0 $0\frac{1}{2}$	0 $8\frac{3}{4}$	958	94
Butter milk.					
Cheese - - lb.	$\frac{1}{2}$	0 6	0 3	166	19
Tea - - oz.	2	0 3	0 6	- -	2
Coffee - - oz.	1	0 1	0 1	- -	1
Chicory.					
Total -	- -	- -	10 $6\frac{1}{2}$	17,726	787

Table No. 74.

ASHTON—[Ordinarily].

Cost . . per Head weekly . . 2s. $4\frac{1}{2}$d.
Income . . . . . weekly . . 37s.
Carbon . per Head daily . . . 3,578 grains.
Nitrogen per Head daily . . . 144 grains.
Family, 8 ; Man, Wife, 6 Children, eldest aged 14.
(Young Children.)
(*Same family as No. 75.*)

Food.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	2	0 $1\frac{1}{2}$	0 3	12,874	602
Flour - - lb.	36	0 2	6 0		
Flour, reckoned as bread - lb.	$50\frac{1}{3}$	- -	- -		
Oatmeal - lb.	5	1/4 10lb.	0 8	1,830	88
Peas - - lb.	1	0 $1\frac{1}{2}$	0 $1\frac{1}{2}$	336	31
Rice - - lb.	$\frac{1}{2}$	0 3	0 $1\frac{1}{2}$	168	4
Potatoes - lb.	35	1/2 20lb.	1 11	3,325	105
Onions - - lb.	2	0 $0\frac{3}{4}$	0 $1\frac{1}{2}$	120	5
Turnips.					
Sugar - - lb.	2	0 $4\frac{1}{2}$	0 9	692	
Treacle - - lb.	2	0 2	0 4	560	
Butter - - lb.	2	1 0	2 0	1,176	
Lard - - lb.	$\frac{1}{2}$	0 9	0 $4\frac{1}{2}$	332	
Dripping.					
Suet.					
Bacon - - lb.	2	0 6	1 0	1,188	24
Meat - - lb.	4	0 7	2 4	1,161	72
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings.					
Milk, new - pints	14	0 $1\frac{1}{4}$	1 $5\frac{1}{2}$	955	37
„ skimmed.					
Butter milk.					
Cheese - - lb.	1	0 7	0 7	332	39
Tea - - oz.	2	0 $2\frac{3}{4}$	0 $5\frac{1}{2}$	- -	2
Coffee - - lb.	$\frac{1}{4}$	1 8	0 5	- -	3
Chicory - - lb.	$\frac{1}{4}$	0 6	0 $1\frac{1}{2}$		
Total -	- -	- -	19 $8\frac{1}{2}$	25,049	1,012

TABLE No. 75.

ASHTON—[NOW].

COST . . per Head weekly . . 1*s.* 8½*d.*
CARBON . per Head daily . . . grains.
NITROGEN per Head daily . . . grains.
FAMILY, 8 ; young Children.
(*Same family as No. 74.*)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	4	0 1½	0 6		
Flour and yeast lb.	30	0 1¾	4 7	11,440	529
Flour, reckoned as bread - lb.	42	- -	- -		
Oatmeal - lb.	5	1/4 10 lb.	0 8	1,830	88
Peas - - lb.	2	0 1½	0 3	672	63
Rice - - lb.	1	0 3	0 3	336	9
Potatoes - lb.	35	1/2 20 lb.	1 11	3,325	105
Onions - - lb.	2	0 0¾	0 1½	332	5
Turnips.					
Sugar - - lb.	½	0 4½	0 2¼	173	
Treacle - - lb.	1	0 2	0 2	280	
Butter - - lb.	1	0 11	0 11	589	
Lard - - lb.	¼	0 9	0 2¼	166	
Dripping.					
Suet.					
Bacon - - lb.	2	0 6	1 0	1.188	24
Meat - - lb.	1	0 7	0 7	325	20
Meat, reckoned without bone.					
Herrings.					
Milk, new - pints	7	0 1¼	0 8¾	478	19
,, skimmed.					
Butter milk.					
Cheese - - lb.	½	0 6	0 3	166	20
Tea - - oz.	1	0 3	0 3	- -	1
Coffee - - lb.	¼	1 8	0 5	- -	3
Chicory - oz.	2	- -	0 0¾		
Soup - - pints	10½	0 0¾	0 8¼		
TOTAL -	- -	- -	13 8¾		

TABLE No. 76.

MANCHESTER—[ORDINARILY].

{ COST . . per Head weekly . . 1*s.* 7¼*d.*
{ INCOME . . . . . weekly . . 17*s.*
CARBON . per Head daily . . . 2,742 grains.
NITROGEN per Head daily . . . 111 grains.
FAMILY, 8; Man, Wife, 6 Children, eldest aged 11. (Young Children.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	56	0 1½	7 0		
Flour - - lb.	2	0 2	0 4	14,437	669
Flour, reckoned as bread - lb.	2¾	- -	- -		
Oatmeal.					
Peas.					
Rice.					
Potatoes - lb.	17½	1/2 20 lb.	1 0	1,662	52
Onions.					
Turnips.					
Sugar - - lb.	1¾	0 5	0 8¾	605	
Treacle - - lb.	1¾	0 2	0 3½	490	
Butter - - lb.	1¾	0 10	1 5½	1,029	
Lard.					
Dripping - lb.	¼	0 8	0 2	166	
Suet - - -	- -	- -	0 1		
Bacon.					
Meat (Sundays) lb.	2	0 7	1 2	645	40
Meat, reckoned without bone.					
Herrings.					
Milk, new - pints	2⅓	0 1½	0 3½	159	12
,, skimmed.					
Butter milk.					
Cheese.					
Tea - - oz.	1	0 3	0 3	- -	2
Coffee - - oz.	1	0 1½	0 1½		
Chicory.					
TOTAL -	- -	- -	12 10¾	19,193	775

TABLE No. 77.

MANCHESTER—[ORDINARILY AND NOW].

{ COST . . per Head weekly . . 3*s.* 2½*d.*
{ INCOME . . . . . weekly . . 48*s.*
CARBON . per Head daily . . . grains.
NITROGEN per Head daily . . . grains.
FAMILY, 8; Man, Wife, 6 Children, eldest aged 22. (Grown Children.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread - - lb.	56	0 1½	7 0		
Flour - - lb.	1	0 1½	0 1½	14,120	660
Flour, reckoned as bread - lb.	1⅓	- -	- -		
Oatmeal.					
Peas - - lb.	¾	0 2	0 1½	252	33
Rice.					
Potatoes - lb.	49	1/2 20 lb.	2 9½	4,655	147
Onions.					
Turnips.					
Sugar - - lb.	3½	0 5½	1 7¼	1,211	
Treacle.					
Butter - - lb.	4½	1 0	4 6	2,646	
Lard - - oz.	6	7*d.* lb.	0 2¾		
Dripping.				544	
Suet - - lb.	½	0 8	0 4		
Bacon - - lb.	3	0 8	2 0	1,782	36
Meat - - lb.	6	0 7	3 6	1,741	108
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings.					
Milk, new - pints	1	0 2	0 2	68	5
,, skimmed.					
Butter milk.					
Cheese - - lb.	1½	0 8	1 0	498	59
Tea - - oz.	4	0 3	1 0	- -	5
Coffee - - lb.	½	1 4	0 8	- -	5
Chicory.					
Other dinners -	- -	- -	0 6		
TOTAL -	- -	- -	25 6½		

APPENDIX.
V. The Cotton Famine.
3. Economics of diet.
Supplement to Dr. E. Smith's Report.
Details of Dietaries.
Families.

TABLE No. 78.

ASHTON—[NOW].

COST . . per Head weekly . . 2*s.* 5*d.*
INCOME . . . . . weekly . . 24*s.*
CARBON . per Head daily . . . 4,179 grains.
NITROGEN per Head daily . . . 166 grains.
FAMILY, 9; Man, Wife, 7 Children, aged 19, 12, 10, 8, 6, 4, 1½ years.

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour - - lb.	60	0 2	10 8	18,368	858
Flour, reckoned as bread - lb.	84	- -	- -		
Oatmeal - lb.	2½	1/6 10lb.	0 4½	758	36
Peas.					
Rice.					
Potatoes - lb.	60	1/2 20lb.	3 6	5,066	160
Onions - - lb.	4	- -	0 3½	186	9
Turnips.					
Sugar - - lb.	4	0 5½	1 10	1,230	62
Treacle - - lb.	2	0 3	0 6	498	
Butter - - lb.	3	1 0	3 0	1,568	
Lard.					
Dripping.					
Suet.					
Bacon - - lb.	3	0 7	1 9	1,584	32
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new.					
,, skimmed.					
Butter milk.					
Cheese.					
Tea - oz.	3	0 3½	0 10½	- -	3
Coffee - oz.	4	0 0¾	0 3	- -	3
Chicory.					
TOTAL -	- -	- -	21 8½	29,258	1,163

TABLE No. 79.

STOCKPORT—[ORDINARILY].

COST . . per Heud weekly . . 2*s.* 5*d.*
INCOME . . . . . weekly . . 40*s.*
CARBON . per Head daily . . . 3,872 grains.
NITROGEN per Head daily . . . 156 grains.
FAMILY, 9 ; Man, Wife, 7 Children, aged 17 to 2½ years.

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour and yeast lb.	60	0 2	10 4	18,368	858
Flour, reckoned as bread - lb.	84	- -	- -		
Oatmeal - lb.	1	0 1½	0 1½	307	15
Peas.					
Rice.					
Potatoes - lb.	42	1*s.* 20lbs.	2 1½	3,547	112
Onions - - lb.	1	0 1	0 1	46	2
Turnips.					
Sugar - - lb.	3	0 6	1 6	922	
Treacle - - lb.	2½	0 2	0 5	622	
Butter - - lb.	3	1 1	3 3	1,568	
Lard - - lb.	¼	0 8	0 2	147	
Dripping.					
Suet.					
Bacon - - lb.	½	0 7	0 3½	263	7
Meat - - lb.	3	0 7	1 9	774	40
Meat, reckoned without bone.					
Herrings.					
Milk, new - pints	4	0 1¼	0 5	243	19
,, skimmed.					
Butter milk.					
Cheese - - lb.	1	0 6	0 6	295	35
Tea - - oz.	2	0 3	0 6	- -	2
Coffee - - oz.	2	0 1¼	0 2½	- -	1
Chicory - oz.	1	- -	0 0½	- -	
TOTAL -	- -	- -	21 8½	27,102	1,091

TABLE No. 80.

BLACKBURN—[NOW].

COST . . per Head weekly . . 1*s.* 4¾*d.*
INCOME . . . . . weekly . . 13*s.*
CARBON . per Head daily . . . 2,945 grains.
NITROGEN per Head daily . . . 129 grains.
FAMILY, 9 ; Man, Wife, 7 Children, aged 14 to 6. (Young Children.)
(*Same family as No.* 81.)

Food.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*	Grains.	Grains.
Bread.					
Flour - - lb	26	0 1½	3 3	9,091	373
Flour, reckoned as bread - lb.	36½	- -	- -		
Oatmeal - lb.	14	0 1½	1 9	4,084	218
Peas.					
Rice.					
Potatoes - lb.	30	1/1 20lb.	1 7½	2,533	80
Onions.					
Turnips.					
Sugar - - lb.	2	0 5	0 10	615	
Treacle - - lb.	2	0 2	0 4	498	
Butter - - lb.	2	0 8	1 4	941	
Lard - - lb.	½	0 7	0 3½	235	
Dripping.					
Suet.					
Bacon.					
Meat - - lb.	2	0 6	1 0	573	35
Meat, reckoned without bone.					
Herrings.	2	0 0½	0 1	59	9
Milk, new.					
,, skimmed pints	35	0 0½	1 5½	1,703	167
Butter milk.					
Cheese - - lb.	½	0 4	0 2	147	17
Tea - - oz.	¾	0 3½	0 2¾	- -	1
Coffee, early once a week - oz.	1	0 1	0 1	- -	1
Chicory.					
Cabbage - lb.	3	- -	0 1½	140	5
TOTAL -	- -	- -	12 6¾	20,619	906

TABLE No. 81.

BLACKBURN—[ORDINARILY].

COST . . per Head weekly . . 1s. $5\frac{3}{4}d$.
CARBON . per Head daily . . . 2,940 grains.
NITROGEN per Head daily . . . 133 grains.
FAMILY, 9 ; young Children.
(*Same family as No.* 80.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread.					
Flour - - lb.	30	0 1½	3 9	9,184	429
Flour, reckoned as bread - lb.	42	- -	- -		
Oatmeal - lb.	12	0 1½	1 6	3,691	186
Peas.					
Rice.					
Potatoes - lb.	30	1/1 20lb.	1 7½	2,533	80
Onions.					
Turnips.					
Sugar - - lb.	2	0 5	0 10	615	
Treacle - - lb.	2	0 2	0 4	280	
Butter - - lb.	2	0 8	1 4	941	
Lard - - lb.	½	0 7	0 3½	296	
Dripping.					
Suet.					
Bacon.					
Meat - - lb.	3	0 6	1 6	774	40
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings - -	2	0 0½	0 1	59	9
Milk, new.					
„ skimmed pints	35	0 0½	1 5½	1,703	167
Butter milk.					
Cheese - - lb.	½	0 4	0 2	147	17
Tea - - oz.	¾	0 3½	0 2¾	- -	1
Coffee - - oz.	1	0 1	0 1	- -	1
Chicory.					
Cabbage, once a week - lb.	3	- -	0 1½	140	5
TOTAL -	- -	- -	13 3¾	20,581	935

Take porridge twice a day.

TABLE No. 82.

MANCHESTER—[ORDINARILY AND NOW].

{ COST . . per Head weekly . . 3s. $5\frac{1}{4}d$.
{ INCOME . . . . . weekly . . 51s. 8d.
CARBON . per Head daily . . . 5,208 grains.
NITROGEN per Head daily . . . 203 grains.
FAMILY, 9 ; Man, Wife, 7 Children, eldest aged 17.

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	100	0 1½	12 6	22,960	1,073
Flour - - lb.	4	0 1½	0 6		
Flour, reckoned as bread - lb.	5	- -	- -		
Oatmeal - lb.	4	0 2	0 8	1,230	62
Peas.					
Rice.					
Potatoes - lb.	40	1/2 20lb.	2 4	3,377	107
Onions.					
Turnips.					
Sugar - - lb.	6	0 5	2 6	1,845	
Treacle.					
Butter - - lb.	5	0 11	4 7	2,613	
Lard - - lb.	½	0 8	0 4	887	
Dripping - - lb.	1	0 6	0 6		
Suet.					
Bacon - - lb.	3	0 8	2 0	1,584	32
Meat - - lb.	6	0 6½	3 3	1,548	96
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings.					
Milk, new - pints	2	0 2	0 4	121	9
„ skimmed.					
Butter milk.					
Cheese - - lb.	1	0 8	0 8	295	35
Tea - - oz.	5	0 3	1 3	- -	5
Coffee - - lb.	¼	1 4	0 4	- -	2
Chicory.					
TOTAL -	- -	- -	31 9	36,460	1,421

TABLE No. 83.

ASHTON—[NOW].

{ COST . . per Head weekly . . 1s. $6\frac{1}{4}d$.
{ INCOME . . . . . weekly . . 18s. 3d.
CARBON . per Head daily . . . 2,989 grains.
NITROGEN per Head daily . . . 135 grains.
FAMILY, 10 ; Man, Wife, 8 Children, aged 19 to 6 years. (Adults and Youths.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head. Carbon.	Per Head. Nitrogen.
		s. d.	s. d.	Grains.	Grains.
Bread - - lb.	8	0 1½	1 0	11,480	536
Flour - - lb.	36	0 2	6 0		
Flour, reckoned as bread - lb.	50⅓	- -	- -		
Oatmeal - lb.	20	1/8 10lb.	3 4	5,536	280
Peas.					
Rice.					
Potatoes - lb.	20	- -	1 0	1,520	48
Onions - - lb.	1	- -	0 1½	42	2
Turnips.					
Sugar - - lb.	1	0 6	0 6	276	
Treacle - - lb.	2	0 2	0 4	448	
Butter - - lb.	1	0 10	0 10	423	
Lard - - lb.	½	0 8	0 4	266	
Dripping.					
Suet.					
Bacon - - lb.	1	0 8	0 8	475	19
Meat.					
Meat, reckoned without bone.					
Herrings - -	6	0 0½	0 3	161	25
Milk, new.					
„ skimmed.					
Butter milk pints	4	0 0½	0 2	168	17
Cheese - - lb.	½	0 8	0 4	32	15
Tea - - oz.	1	0 3	0 3	- -	1
Coffee - - oz.	2	0 1	0 2	- -	1
Chicory.					
TOTAL -	- -	- -	15 3½	20,927	944

TABLE No. 84.

PRESTON—[Now].

COST . . . . per Head weekly . . . . 1*s.* 0¼*d.*
INCOME . . . . weekly . . . .
CARBON . . . per Head daily . . . . . grains.
NITROGEN . . per Head daily . . . . . grains.
FAMILY, 11 ; Man, Wife, 9 Children, aged 20 years to 6 months.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread - - - lb.	66	0 1½	8 3	11,808	552
Flour.					
Flour, reckoned as bread.					
Oatmeal.					
Peas.					
Rice.					
Potatoes.					
Onions - - - lb.	1	- -	0 0½	38	1
Turnips.					
Sugar - - - lb.	1½	0 5	0 7½	359	
Treacle - - - lb.	2	0 2	0 4	407	
Butter.					
Lard.					
Dripping.					
Suet.					
Bacon.					
Meat.					
Meat, reckoned without bone.					
Herrings - - - -	12	0 0½	0 6	293	45
Milk, new.					
Milk, skimmed - - pint	1	- -	0 1	40	4
Butter milk.					
Cheese.					
Tea - - - - oz.	1	0 2½	0 2½	- -	1
Coffee - - - oz.	4	0 0¾	0 3	- -	2
Chicory.					
Soup - - - - pints	24	0 0¾	1 6		
TOTAL - -	- -	- -	11 3½		

TABLE No. 85.

ASHTON—[Now].

COST . . . . per Head weekly . . . . 1*s.* 11*d.*
INCOME . . . . weekly . . . . 24*s.* 7*d.*
CARBON . . . per Head daily . . . . . 3,198 grains.
NITROGEN . . per Head daily . . . . . 133 grains.
FAMILY, 12 ; Man, Wife, 10 Children, aged 21, 17, 15, 14, 13, 10, 7, 5, 4, and ½ year.

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread - - - lb.	16	0 1½	2 0	12,527	508
Flour and yeast - - lb.	36	0 2	6 5		
Flour, reckoned as bread - lb.	50⅓	- -	-		
Oatmeal - - - lb.	25	1/6 10lbs.	3 9	5,775	292
Peas.					
Rice.					
Potatoes - - - lb.	15	1/2 20lbs.	0 10½	950	30
Onions - - - lb.	2	0 1	0 2	70	3
Turnips.					
Sugar - - - lb.	3	0 6	1 6	692	
Treacle.					
Butter - - - lb.	2	1 0	2 0	784	
Lard - - - - lb.	¼	0 8	0 2	98	
Dripping.					
Suet.					
Bacon - - - lb.	1	0 8	0 8	396	8
Meat.					
Meat, reckoned without bone.					
Herrings.					
Milk, new - - - pints	24	0 1¼	2 6	1,092	86
Milk, skimmed.					
Butter milk.					
Cheese.					
Tea - - - - oz.	2	0 3½	0 7	- -	2
Coffee - - - oz.	4	1*s.* 8*d.* lb.	0 5	- -	2
Chicory.					
TOTAL - -	- -	- -	21 0	22,384	931

APPENDIX.
V. The Cotton Famine.
3. Economics of diet.
Supplement to Dr. E. Smith's Report.
Details of Dietaries.
Families.

TABLE No. 86.

ASHTON—[ORDINARILY].

COST . . . . per Head weekly . . . . 3*s.* 5*d.*
INCOME . . . . weekly . . . . 60*s.*
CARBON. . . per Head daily . . . . . 4,548 grains.
NITROGEN. . per Head daily , ... 199 grains.
FAMILY, 14 ; Man, Wife, Mother, 11 Children, mostly grown up.

(*Same family as No.* 87.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread - - - - lb.	6	0 1½	0 9		
Flour and yeast - - - lb.	87	0 1½	15 6	17,949	840
Flour, reckoned as bread - lb.	121¾	- -	- -		
Oatmeal - - - lb.	10	1/6 10 lbs.	1 6	1,977	100
Peas - - - - lb.	4	0 2	0 8	800	70
Rice.					
Potatoes - - - lb.	60	1/1 20 lbs.	3 6	3,257	103
Onions - - - lb.	5	- -	0 6	150	7
Turnips.					
Sugar - - - - lb.	7	0 6	3 6	1,384	
Treacle - - - lb.	3	0 3	0 9	480	
Butter - - - - lb.	5	1 0	5 0	1,680	
Lard - - - - lb.	1½	0 8	1 0	567	
Dripping.					
Suet.					
Bacon - - - - lb.	2½	0 8	1 8	848	17
Meat - - - - lb.	9	0 7½	5 7½	1,493	77
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings - - - -	6	0 0½	0 3	115	17
Milk, new - - - pints	14	0 1¼	1 5½	546	43
,, skimmed.					
Butter milk - - - pints	14	0 0½	0 7	420	43
Cheese - - - - lb.	2	0 8	1 4	380	45
Tea - - - - lb.	½	4 8	2 4	- -	6
Coffee - - - - lb.	½	1 8	0 10	- -	3
Chicory - - - lb.	¼	0 6	0 1½		
TOTAL - - -	- -	- -	47 11	31,836	1,371

TABLE No. 87.

ASHTON—[NOW].

COST . . . . per Head weekly . . . . 2*s.* 2¼*d.*
INCOME . . . . weekly . . . . 24*s.* 4*d.*
CARBON . . . . per Head daily . . . . 3,826 grains.
NITROGEN . . . per Head daily . . . . 175 grains.
FAMILY, 14.

(*Same family as No.* 86.)

FOOD.	Quantity.	Price.	Total Cost.	Per Head.	
				Carbon.	Nitrogen.
		s. d.	*s. d.*	Grains.	Grains.
Bread.					
Flour (some brown) and yeast lb.	87	- -	13 7	17,106	800
Flour, reckoned as bread - lb.	121¾	- -	- -		
Oatmeal - - - lb.	10	- -	1 4	1,977	100
Peas - - - - lb.	8	0 1½	1 0	1,594	139
Rice.					
Potatoes - - - lb.	35	1 2	2 0	1,900	60
Onions - - - lb.	2	0 1¼	0 2½	60	3
Turnips.					
Sugar - - - - lb.	4	0 6	2 0	791	
Treacle - - - lb.	3	- -	0 5½	480	
Butter - - - - lb.	3	1 0	3 0	1,008	
Lard - - - - lb.	½	0 8	0 4	190	
Dripping.					
Suet.					
Bacon - - - - lb.	1	0 8	0 8	339	7
Meat - - - - lb.	4	0 7½	2 6	664	41
Meat, reckoned without bone, less $\frac{1}{10}$th.					
Herrings.					
Milk, new - - - pints	7	0 1¼	0 8¾	273	22
,, skimmed.					
Butter milk - - - pints	7	0 0½	0 3½	210	21
Cheese - - - - lb.	1	0 6	0 6	190	23
Tea - - - - oz.	6	0 3½	1 9	- -	4
Coffee - - - - lb.	¼	1 8	0 5	- -	2
Chicory - - - oz.	2	0 6	0 0¾		
TOTAL - -	- -	- -	30 9½	26,782	1,222

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3. Economics of diet.

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Details of Dietaries.

Public Establishments.

Soup.

TABLE No. 89.—MANCHESTER.

The New Institution, Pendleton.—SIR ELKANAH ARMITAGE AND SONS.

SOUP.

QUANTITY per Ration		1 pint.
COST per Ration		0·51*d.*
NUTRITIVE VALUE per Ration	Carbon	450 grains.
	Nitrogen	33 grains.

To make 56 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef - - - lb.	3	0 4½	1 3¾	5·34	13,777	640
Bones, ⅛th - - lb.	½			·9	704	18
Ham.						
Bacon.						
Peas, whole, blue - lb.	4	0 1½	0 3	7·12	18,816	1,764
,, white.						
,, split - - lb.	2	0 3	0 6	3·56	9,408	882
,, meal.						
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl - - lb.	½	0 3½	0 1¾	·9	2,390	81
,, Scotch.						
Rice.						
Carrots.						
Turnips.						
Cabbage.						
Onions.						
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper.						
Curry.						
Salt.						
Herbs.			0 2			
TOTAL - -	- -	- -	2 4½	- -	45,095	3,385

TABLE No. 90.—MANCHESTER.

ARDWICK COOKING KITCHEN (Miss Hilton's).

SOUPS—VEGETABLE.

QUANTITY per Ration		1 pint.
COST per Ration		0·91*d.*
NUTRITIVE VALUE per Ration	Carbon	595 grains.
	Nitrogen	27 grains.

To make 120 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef - - - lb.	12	0 5	5 0	10·0	25,800	1,600
Bones - - - lb.	6	0 1½	0 9	5·	3,915	100
Ham.						
Bacon.						
Peas, whole, blue.						
,, white.						
,, split.						
,, meal.						
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl - - lb.	12	0 1¾	1 9	10·	26,561	910
,, Scotch.						
Rice.						
Carrots - - - lb.	6	0 0¾	0 4½	5·	1,920	70
Turnips.						
Cabbage.						
Onions - - - lb.	4	0 0¾	0 3	3·3	1,370	48
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint - - - -	- -	- -	1 0			
Marjoram.						
Pepper.						
Curry.						
Salt.						
TOTAL - -	- -	- -	9 1½	- -	59,566	2,728

TABLE No. 91.—MANCHESTER.

ARDWICK COOKING KITCHEN.—Miss Hilton.

PEA SOUP.

QUANTITY per Ration . . . . . . 1 pint.
COST per Ration . . . . . . 1·24*d.*
NUTRITIVE VALUE per Ration . { Carbon . 873 grains.
{ Nitrogen . 61 grains.

To make 120 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Beef - - - lb.	6	0 5	2 6	5·	12,900	800
Bones - - - lb.	12	0 1½	1 6	10·	7,830	243
Ham.						
Bacon.						
Peas, whole, blue.						
,, ,, white.						
,, split - - lb.	16	0 1½	2 0	13·3	35,840	4,090
,, meal.						
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl - lb.	12	0 1¾	1 9	10·	26,560	910
,, Scotch.						
Rice.						
Carrots - - - lb.	4	- -	0 9	3·3	4,200	140
Turnips - - - lb.	4			3·3		
Cabbage.						
Onions - - - lb.	4			3·3		
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - oz.	2	- -	- -	1·6		
Curry.						
Salt - - - lb.	2	- -	- -	1·6		
TOTAL - -	- -	- -	12 5	- -	87,330	6,183

TABLE No. 92.—MANCHESTER.

MR. BIRCH'S SEWING CLASSES, 220, City Road.

PEA SOUP.

QUANTITY per Ration . . . . . 1 pint.
COST per Ration . . . . . 0·56*d.*
NUTRITIVE VALUE per Ration . { Carbon . 510 grains.
{ Nitrogen . 38 grains.

To make 160 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Beef - - - lb.	10	0 3	5 0	6·25	16,125	1,000
Bones, legs, 50°/₀ - lb.	10			6·25	5,106	175
Ham.						
Bacon.						
Peas, whole, blue - lb.	16	0 1¼	2 0	10·	26,880	2,520
,, ,, white.						
,, split.						
,, meal.						
Oatmeal.						
Flour - - - lb.	2	0 2	0 4	1·25	3,320	150
Potatoes.						
Barley, pearl.						
,, Scotch.						
Rice.						
Carrots.						
Turnips.						
Cabbage.						
Onions.						
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - oz.	2	- -	0 2	1·25		
Curry.						
Salt - - - lb.	2	- -	0 0½	1·25		
TOTAL - -	- -	- -	7 6½	- -	51,431	3,845

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Public Establishments.

Soup.

TABLE No. 93.—MANCHESTER.

MESSRS. CREWDSON'S FACTORY, Fleet Street.

SOUP.

QUANTITY per Ration . . . . . 1 pint.
COST per Ration . . . . . 0·51*d.*
NUTRITIVE VALUE per Ration . { Carbon . 369 grains.
Nitrogen . 18 grains.

To make 40 gallons or 320 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef - - - lb.	22½	0 3	11 3	7	18,060	1,120
Bones, shins, 50°/₀ - lb	22½			7	5,719	196
Ham.						
Bacon.						
Peas, whole, blue.						
,, ,, white.						
,, split.						
,, meal.						
Oatmeal - - - lb.	2	0 2	0 4	·6	1,660	84
Flour - - - lb.	1½	- -	0 4	·46	1,320	57
Potatoes.						
Barley, pearl - - lb.	9	0 2	1 6	2·8	7,436	254
,, Scotch.						
Rice.						
Carrots - - - lb.	7	- -	0 3	2·2	2,730	91
Turnips - - - lb.	7	- -	0 3	2·2		
Cabbage.						
Onions - - - lb.	7	- -	0 4	2·2		
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper.						
Curry.						
Salt - - - -	- -	- -	0 1			
Pot herbs - - -	- -	- -	0 1			
Cloves - - - -	- -	- -	0 1			
TOTAL - - -	- -	- -	14 6	- -	36,925	1,802

TABLE No. 94.—MANCHESTER.

DRAKE STREET SOUP KITCHEN.

SOUP.

QUANTITY per Ration . . . . . 1 quart.
COST per Ration . . . . . 0·66*d.*
NUTRITIVE VALUE per Ration . { Carbon . 776 grains.
Nitrogen . 61 grains.

To make 600 quarts or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef,legs,necks, shins lb.	10	0 3½	8 9	1·66	4,300	267
Bones - - - lb.	20			3·33	2,410	80
Ham.						
Bacon.						
Peas, whole, blue - lb.	120	0 1½	15 0	20·	53,760	5,040
,, ,, white.						
,, split.						
,, meal.						
Oatmeal.						
Flour - - - lb.	36	0 2	6 0	6·	15,930	720
Potatoes.						
Barley, pearl.						
,, Scotch.						
Rice.						
Carrots, sometimes.						
Turnips, ,,						
Cabbage - - - lb.	- -	- -	0 4	·7	1,368	45
Onions - - - lb.	12	0 0¾	0 9	2·		
Leeks.						
Celery - - sticks	3	0 1½	0 4½	·5		
Parsley.						
Thyme.						
Mint, rubbed down -	- -	- -	0 3			
Marjoram ,, - -	- -	- -	0 3			
Pepper - - - oz.	8	1*s.* 4*d.* lb.	0 8	1·33		
Curry.						
Salt.						
Mustard - - oz.	8	1*s.* 4*d.* lb.	0 8	1·33		
TOTAL - - -	- -	- -	33 0½	- -	77,768	6,152

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Soup.

TABLE No. 95.—MANCHESTER.

DISTRICT PROVIDENT SOCIETY SEWING SCHOOL.—Mrs. Anson.

PEA SOUP.

QUANTITY per Ration . . . . . . 1 pint.
COST per Ration . . . . . . 0·6*d*.
NUTRITIVE VALUE per Ration . { Carbon . 929 grains. / Nitrogen . 84 grains.

Besides bacon liquor.—To make 141 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef.						
Bones.						
Ham.						
Bacon, liquor from lb.	20					
Peas, whole, blue - lb.	46	0 3	5 9	16·3	87,648	8,214
,, ,, white.						
,, split.						
,, meal.						
Oatmeal.						
Flour - - - lb.	1½	0 2¼	0 3¼	1·	2,656	120
Potatoes.						
Barley, pearl.						
,, Scotch.						
Rice.						
Carrots.						
Turnips.						
Cabbage.						
Onions - - - lb.	9	0 1	0 9	6·3	2,662	88
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint - - - -	- -	- -	0 2			
Marjoram.						
Pepper - - - }	- -	- -	0 2			
Curry.						
Salt - - - }						
TOTAL - -	- -	- -	7 1¼	- -	92,966	8,422

TABLE No. 96.—MANCHESTER.

FRIEND'S SOUP KITCHEN (until 1863).

SOUP.

QUANTITY per Ration . . . . . 1 quart.
COST per Ration . . . . . 1*d*.
NUTRITIVE VALUE per Ration . { Carbon . 935 / Nitrogen . 68

To make 100 gallons or 400 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef, fore-quarters lb.	56	} 0 3½	20 5	14·	36,120	2,240
Bones, say ⅕th - lb.	14	}		3·5	2,540	85
Ham.						
Bacon.						
Peas, whole, blue - lb.	65	43/9 qr.	5 5½	16·25	43,824	4,107
,, ,, white.						
,, split.						
,, meal.						
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl.						
,, Scotch - lb.	50	20*l*. 10*s*. ton.	5 7	12·5	8,300	284
Rice.						
Carrots - - - lb.	16	- -	0 4	4·	1,536	56
Turnips.						
Cabbage.						
Onions - - - lb.	12	- -	0 6	3·	1,260	42
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - oz.	10	- -	0 8½	2·5		
Curry.						
Salt - - - lb.	8	- -	0 1	2·		
TOTAL - -	- -	- -	33 1	- -	93,580	6,814

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Public Establishments.

Soup.

TABLE No. 97.—MANCHESTER.

GAYTHORN COOKING DEPÔT.

SOUP.—BROTH.

QUANTITY per Ration . . . . . 1 lb.
COST per Ration besides the Meat Liquor, . 0·18*d*.
NUTRITIVE VALUE per Ration . { Carbon . 300 grains.
{ Nitrogen . 12 grains.

To make 45 gallons, or 360 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. d.	s. d.		Grains.	Grains.
Beef, liquor from -	lb.	25	0 2	0 6	7	5,205	42
Bones - - -	lb.	3			1	748	20
Ham.							
Bacon.							
Peas, whole, blue -	lb.	6½	0 1·24	0 8	1·8	7,526	705
„ „ white.							
„ split - -	lb.	3½	0 1·35	0 4¾	1·		
„ meal.							
Oatmeal - - -		a little.					
Flour.							
Potatoes.							
Barley, pearl -	lb.	11½	13/6 cwt. 1·35*d*. lb.	1 3½	3·2	8,499	291
„ Scotch.							
Rice.							
Carrots - - -	lb.	13	0 0·24	0 3⅓	3·6	6,090	203
Turnips - - -	lb.	13	0 0·13	0 1¾	3·6		
Cabbage, greens, various - - -	lb.	29	- -	1 6	7·22		
Onions.							
Leeks.							
Celery.							
Parsley.							
Thyme.							
Mint.							
Marjoram.							
Pepper - - - -		- -	- -	0 9			
Curry.							
Salt - - - -		- -	- -	0 1			
TOTAL - -		- -	- -	5 6	- -	30,068	1,261

TABLE No. 98.—MANCHESTER.

GAYTHORN COOKING DEPÔT (J. Pender & Co.)

SOUP—VEGETABLE.

QUANTITY per Ration . . . . . 1 pint.
COST per Ration, besides Meat Liquor . . 0·255*d*.
NUTRITIVE VALUE per Ration . { Carbon . 490 grains.
{ Nitrogen . 36 grains.

To make 45 gallons, 360 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. d.	s. d.		Grains.	Grains.
Beef, liquor from -	lb.	25	- -	- -	7	5,205	42
Bones - - -	lb.	3	- -	- -	1	748	20
Ham.							
Bacon.							
Peas, whole, blue -	lb.	35	27/252lb., 1·24*d*. lb.	3 7½	9·72	34,944	3,276
„ „ white.							
„ split - -	lb.	11½	13/6 cwt., 1·35*d*. lb.	1 3½	3·3		
„ meal.							
Oatmeal.							
Flour.							
Potatoes.							
Barley, pearl.							
„ Scotch.							
Rice.							
Carrots - - -	lb.	24	45/ ton, 0·24*d*. lb.	0 5¾	6·66	8,190	273
Turnips, Swede -	lb.	24	25/ ton, 0·13*d*. lb.	0 3⅛	6·66		
Cabbage.							
Onions - - -	lb.	20	- -	1 0	5·55		
Leeks - - -	lb.	2	- -	- -	·55		
Celery.							
Parsley.							
Thyme.							
Mint.							
Marjoram.							
Pepper.							
Curry - - - -		- -	- -	1 0			
Salt - - - -							
Herbs - - - -							
TOTAL - -		- -	- -	7 8	- -	49,087	3,611

TABLE No. 99.—MANCHESTER.

INSTITUTE FOR THE UNEMPLOYED, 26, City Road (Mr. Birch's).

PEA—SOUP.

QUANTITY per Ration . . . . . 1 pint.
COST per Ration . . . . . 0·44*d*.
NUTRITIVE VALUE per Ration { Carbon . 492 grains.
NUTRITIVE VALUE per Ration { Nitrogen . 32 grains.

To make 40 gallons, or 320 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Beef, lower part of legs - -	lb.	15	0 3	7 6	4·68	12,080	746
Bones, 50°/₀ - -	lb.	15			4·68	3,814	132
Ham.							
Bacon.							
Peas, whole, blue -	lb.	30	0 1¼	3 1½	9·37	24,998	2,343
" " white.							
" split.							
" meal.							
Oatmeal.							
Flour.							
Potatoes.							
Barley, pearl.							
" Scotch.							
Rice - - -	lb.	10	0 1	0 10	3·12	8,400	29
Carrots.							
Turnips.							
Cabbage.							
Onions.							
Leeks.							
Celery.							
Parsley.							
Thyme.							
Mint.							
Marjoram.							
Pepper - - -	oz.	4	- -	0 4	1·25		
Curry.							
Salt - - -	lb.	4	- -	0 1	1·25		
TOTAL - -		- -	- -	11 10½	- -	49,292	3,250

TABLE No. 100.—MANCHESTER.

ST. JUDE'S.

SOUP.

QUANTITY per Ration . . . . . 1½ pint.
COST per Ration. . . . . . 0·8*d*.
NUTRITIVE VALUE per Ration { Carbon . 913 grains.
NUTRITIVE VALUE per Ration { Nitrogen . 72 grains.

To make 80 gallons, or 430 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Beef - - -	lb.	38	0 3½	14 7	9·	23,220	1,440
Bones - - -	lb.	12			2·8	2,192	67
Ham.							
Bacon.							
Peas, whole, blue -	lb.	80	0 1⅛	7 6	18·6	49,996	5,086
" " white.							
" split.							
" meal.							
Oatmeal.							
Flour.							
Potatoes.							
Barley, pearl.							
" Scotch -	lb.	20	0 2	3 4	4·7	8,483	427
Rice.							
Carrots - - -	lb.	40	0 0⅜	2 6	9·3	3,571	130
Turnips.							
Cabbage.							
Onions - - -	lb.	40			9·3	3,906	130
Leeks.							
Celery.							
Parsley - - -	-	- -					
Thyme.							
Mint - - -	-	- -					
Marjoram.			- -	1 0			
Pepper - - -	-	- -					
Curry.							
Salt - - -	-	- -					
TOTAL - -		- -	- -	28 11	- -	91,388	7,280

TABLE No. 101.—MANCHESTER.

ST. MARK'S SOUP KITCHEN.

SOUP.

QUANTITY per Ration . . . . . . 1 quart.
COST per Ration . . . . . . 0·58*d.*
NUTRITIVE VALUE per Ration { Carbon . 822 grains.
{ Nitrogen . 58 grains.

To make 60 gallons, or 240 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef, legs, shins, neck lb.	22	0 3½	7 10½	9·1	23,478	1,456
Bones, ⅕th - - -	5			2·	1,635	57
Ham.						
Bacon - - - lb.	4	0 5	1 8	1·66	9,334	130
Peas, whole, blue - lb.	40	-	-	16·66	45,588	4,125
,, ,, white.						
,, split.						
,, meal.						
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl.						
,, Scotch.						
Rice.						
Carrots - - - lb.	4	0 0½	0 2	1·66	2,240	74
Turnips - - lb.	4	-	0 1½	1·66		
Cabbage.						
Onions - - - lb.	5	-	0 6	2·		
Leeks.						
Celery - - sticks	3	0 1½	0 4⅝			
Parsley.						
Thyme.						
Mint - - -	-	-	0 3			
Marjoram - -						
Pepper - - - oz.	4	1*s.* 4*d.* lb.	0 4	1·66		
Curry.						
Salt.						
Mustard - - oz.	4	1*s.* 4*d.* lb.	0 4	1·66		
TOTAL - -	-	-	11 7½	-	82,276	5,842

TABLE No. 102.—MANCHESTER.

ST. PHILIP'S SOUP KITCHEN.

PEA SOUP.

QUANTITY per Ration . . . . . . 1 quart.
COST per Ration . . . . . . 0·89*d.*
NUTRITIVE VALUE per Ration . { Carbon . 1,242 grains.
{ Nitrogen . . 65 grains.

To make 100 quarts.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef.						
Bones.						
Ham.						
Bacon - - - lb.	12	0 4	4 0	12	51,181	942
Peas, whole, blue - lb.	20	0 1¼	2 1	20	53,760	5,040
,, ,, white.						
,, split.						
,, meal.						
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl.						
,, Scotch.						
Rice - - - lb.	6	0 1¼	0 7½	6	16,128	420
Carrots - - - lb.	4	less than 0 0½	0 1½	4	1,536	56
Turnips.						
Cabbage.						
Onions - - - lb.	4	0 1	0 4	4	1,680	56
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - oz.	2	-	0 2	2		
Curry.						
Salt - - - -	-	-	0 1			
TOTAL - -	-	-	7 5	-	124,284	6,514

Table No. 103.—MANCHESTER.

Messrs. Stirling's Factory.—Men.

SOUP.

Quantity per Ration . . . . . . 1 pint.
Cost per Ration . . . . . . 0·72*d.*
Nutritive Value per Ration . { Carbon . 665 grains.
{ Nitrogen . 50 grains.

To make 120 pints or rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef - - - lb.	11	} 0 3	5 0	{ 9·2	23,736	1,472
Bones, shanks, 50°/ₒ lb.	9			{ 7·5	6,131	212
Ham.						
Bacon.						
Peas, whole, blue - lb.	12	0 1	1 0	10·	28,256	3,024
" " white.						
" split.						
" meal.						
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl - lb.	2½	0 2½	0 6¼	2·	5,312	182
" Scotch.						
Rice.						
Carrots - - - lb.	} - -	0 1	} 0 5	7·5	3,150	105
Turnips - - lb.	9	0 0½				
Cabbage.						
Onions.						
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - oz.	2	0 1	0 2	1·75		
Curry.						
Salt - - - lb.	2	- -	0 0½	1·75		
Cloves - - - oz.	½	0 2	0 1	·41		
Total - -	- -	- -	7 2¾	- -	66,585	4,995

Table No. 104.—MANCHESTER.

Messrs. Stirling's Factory.—Women.

SOUP.

Quantity per Ration . . . . . . 1 pint.
Cost per Ration . . . . . . 0·55*d.*
Nutritive Value per Ration . { Carbon . 432 grains.
{ Nitrogen . 34 grains.

To make 232 pints or rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef - - - lb.	16½	} 0 3	7 6	{ 7·	18.060	1,120
Bones, shanks, 50°/ₒ lb.	13½			{ 6·	4,905	170
Ham.						
Bacon.						
Peas, whole, blue - lb.	18	0 1	1 6	7·76	20,960	1,960
" " white.						
" split.						
" meal.						
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl - lb.	4	0 2½	0 10	1·7	7,171	154
" Scotch.						
Rice.						
Carrots - - - lb.	} 12	- -	0 7	5·17	2,184	72
Turnips - - lb.						
Cabbage - - lb.						
Onions.						
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - oz.	3	0 1	0 3	1·25		
Curry.						
Salt - - - lb.	3	0 0¼	0 0¾	1·25		
Cloves - - - oz.	¾	0 1½	0 1	·32		
Total - -	- -	- -	10 9¾	- -	43,280	3,476

Appendix.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Details of Dietaries.

Public Establishments.

Soup.

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Details of Dietaries.

Public Establishments.

Soup.

TABLE No. 105.—WIGAN.

MESSRS. ECKERSLEY AND SON'S FACTORY.

SOUP.

QUANTITY per Ration . . . . . . 1 quart.
COST per Ration . . . . . . 1·55*d*.
NUTRITIVE VALUE per Ration . { Carbon . 956 grains.
Nitrogen . 43 grains.

To make 110 gallons, or 440 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. d.	s. d.		Grains.	Grains.
Beef - - -	lb.	68½	0 6	40 0	15·5	39,990	2,480
,, bone - - -	-	11½			2·6	5,481	170
Bones - - -	lb.	8	0 1½	1 0	4·4		
Bacon.							
Peas, whole, blue.							
,, ,, white.							
,, split.							
,, meal.							
Oatmeal - -	lb.	7	0 2	1 2	1·6	4,428	224
Flour.							
Potatoes.							
Barley, pearl.							
,, Scotch -	lb.	30	- -	5 0	7·	18.592	637
Rice - - -	lb.	40	- -	6 8	9·	24,192	630
Carrots.							
Turnips.							
Oabbage.							
Onions - - -	lb.	18	0 1	2 0	7·	2,940	98
Leeks - - -	lb.	12					
Celery.							
Parsley.							
Thyme - - - -	-	- -	- -	0 1			
Mint.							
Marjoram.							
Pepper.							
Curry.							
Salt.							
TOTAL - -		- -	- -	56 11	- -	5,623	4,239

TABLE No. 106.—WIGAN.

MESSRS. W. WOOD AND SON'S FACTORY.

SOUP.

QUANTITY per Ration . . . . . . 1 quart.
COST per Ration . . . . . . 1·57*d*.
NUTRITIVE VALUE per Ration . { Carbon . 975 grains.
Nitrogen . 53 grains.

To make 200 quarts.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. d.	s. d.		Grains.	Grains.
Beef - - -	lb.	33	0 6	20 3	16·5	42,800	2,666
Bones - - -	lb.	15	0 1½		7·5	5,855	150
Bacon.							
Peas, whole, blue -	lb.	1	7/3 60 lbs.	1 2½	5·	13,440	1,260
,, ,, white.							
,, split.							
,, meal.							
Oatmeal - - -	lb.	4	0 1·6	0 6½	2·	5,536	280
Flour.							
Potatoes.							
Barley, pearl.							
,, Scotch -	lb.	10	0 2	1 8	5·	13,280	455
Rice - - - -	lb.	10	1 ·85	1 6½	5·	13,440	350
Carrots - - -	lb.	5	8*d*. 20 lbs.	0 2	2·5	3,150	105
Turnips - -	lb.	5	4*d*. 20 lbs.	0 1	2·5		
Cabbage.							
Onions - - -	lb.	5	0 0½	0 2½	2·5		
Leeks.							
Celery.							
Parsley.							
Thyme.							
Mint.							
Marjoram.							
Pepper - - -	oz.	4	- -	0 4	2·		
Curry.							
Salt - - - -	-	- -	- -	0 2			
TOTAL - -		- -	- -	26 2	- -	97,501	5,316

TABLE No. 107.—WIGAN.

JOHN WOOD AND CO.'S MILL.

SOUP.

QUANTITY per Ration . . . . . . 1 quart.
COST per Ration . . . . . . 1·51*d.*
NUTRITIVE VALUE per Ration . { Carbon . 947 grains.
Nitrogen . 58 grains.

To make 350 quarts or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Beef - - - lb.	75	0 5½	34 4½	21·4	55,212	3,424
Bones.						
Bacon.						
Peas, whole, blue - lb.	20	32*s.* 240lbs.	2 8	5·7	15,321	1,436
„ „ white.						
„ split.						
„ meal.						
Oatmeal, coarse - lb.	8	32*s.* 240lbs.	1 0¾	2·3	6,360	326
Flour.						
Potatoes.						
Barley, pearl - - lb.	22	18*s.* cwt.	3 8	6·3	16,732	573
„ Scotch.						
Rice.						
Carrots - - - lb.	6	3*d.* 4 lb.	0 4½	1·7	652	52
Turnips.						
Cabbage.						
Onions - - - - }	4	0 1	0 4	1·1	460	15
Leeks - - - - }						
Celery - - - -	2 sticks.	- -	} 0 6			
Parsley - - - lb.	2	0 1½				
Thyme - - bunches	6	- -	0 3			
Mint.						
Marjoram.						
Pepper - - oz.	8	- -	0 8	2·3		
Curry.						
Salt - - - -	- -	- -	0 2			
Brown sugar, burnt lb.	1½	0 4	0 6	·43		
TOTAL - -	- -	- -	44 6¾	- -	94,737	5,826

TABLE No. 108.—PRESTON.

PRESTON RELIEF FUND.

SOUP—MEAT.

QUANTITY per Ration . . . . . 1 quart.
COST per Ration . . . . . 1·24*d.*
NUTRITIVE VALUE per Ration . { Carbon . 1,402 grains.
Nitrogen . 52 grains.

To make 700 quarts or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Beef, shins, briskets, stickings - lb.	} 112	} 0 4½	42 0	{ 16·	41,280	1,120
Bones, 15°/₀ - - lb.	18			2·57	1,980	62
Ham.						
Bacon.						
Peas, whole, blue - lb.	30	0 1¼	3 1½	4·28	12,504	1,078
„ „ white.						
„ split.						
„ meal.						
Oatmeal - - lb.	30	0 1½	3 9	4·28	11,848	599
Flour.						
Potatoes.						
Barley, pearl.						
„ Scotch - lb.	150	13*s.* cwt. 1·4*d.* lb.	17 6	21·4	56,838	1,947
Rice - - - lb.	30	11*s.* cwt. 1·18*d.* lb.	2 11½	4·28	11,848	300
Carrots - - - lb.	40	7*s.* 240lbs. 0·35*d.* lb.	1 2	5·71	2,193	80
Turnips.						
Cabbage.						
Onions - - - lb.	30	- -	1 6	4·28	1,798	60
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper.						
Curry - - - oz.	8	0 0¾	0 6	1·14		
Salt - - - lb.	12	- -	0 3	1·71		
TOTAL - -	- -	- -	72 9		140,289	5,246

TABLE No. 109.—BLACKBURN.

MRS. GLADSTONE'S SOUP KITCHEN.

SOUP.

QUANTITY per Ration . . . . 1 quart.
COST per Ration . . . . . Nearly 0·94*d*.
NUTRITIVE VALUE per Ration { Carbon . 1,048 grains.
{ Nitrogen . 75 grains.

To make 1,200 quarts or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Beef - - -	lb.	52	0 4½	25 10	4·33	11,180	693
Bones - - -	lb.	8			·66	588	16
Ham - - -	lb.	60	0 5	25 0	5·	12,900	800
Pigs' cheeks, salted	lb.	50	0 3½	14 7	4·17	17,785	325
Peas, whole, blue.							
" " white	lb.	240	24*s*.240lbs.	24 0	20·	53,760	5,040
" split.							
" meal - -	lb.	25	25*s*.240lbs.	2 5	2·08	5,600	524
Oatmeal.							
Flour.							
Potatoes.							
Barley, pearl.							
" Scotch.							
Rice.							
Carrots.							
Turnips (Swedes)	lb.	80	1/6 cwt.	1 2	6·66	3,000	100
Cabbage.							
Onions - - -	lb.	6	1*s*. 20 lbs.	0 4¼	·5		
Leeks.							
Celery.							
Parsley.							
Thyme.							
Mint.							
Marjoram.							
Pepper - - - -		-	-	1 0			
Curry.							
Salt - - - -		-	-				
TOTAL - -		-	-	94 4¼	-	104,813	7,498

TABLE No. 110.—BLACKBURN.

POLYDORE SOUP KITCHEN.

SOUP.

QUANTITY per Ration . . . . 1½ pint.
COST per Ration . . . . . 1*d*.
NUTRITIVE VALUE per Ration { Carbon . 1,076 grains.
{ Nitrogen . 67 grains.

To make 100 gallons, or 536 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Beef - - -	lb.	48	0 4½	20 3	9·	23,220	1,440
Bones - - -	lb.	6			1·	783	24
Bacon.							
Peas, whole, blue.							
" " white	lb.	61	24/6 240lb.	6 1	11·3	30,464	2,656
" split - -	lb.	30	0 1½	3 9	5·6	15,232	1,328
" meal.							
Oatmeal.							
Flour.							
Potatoes.							
Barley, pearl.							
" Scotch -	lb.	69	14*s*. cwt.	8 8	12·8	33,996	1,164
Rice.							
Carrots - - -	lb.	20	7/6 240lbs.	0 8	3·73	3,990	133
Turnips - -	lb.	20	4/6 240lbs.	0 4	3·73		
Cabbage.							
Onions - - -	lb.	11	7/0 240lbs.	0 4	2·		
Leeks.							
Celery.							
Parsley.							
Thyme.							
Mint.							
Marjoram.							
Pepper - - - -		-	-	0 5			
Curry.							
Salt - - - -		-	-				
TOTAL - -		-	-	46 6	-	107,685	6,765

Table No. 111.—BLACKBURN.

Shakespeare Mill.

SOUP.

Quantity per Ration . . . . . 1¼ pints.
Cost per Ration . . . . . .
Nutritive Value per Ration . { Carbon . 969 grains. Nitrogen . 58 grains.

To make 250 pints, or 200 rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	s. d.		Grains.	Grains.
Beef, shins - - lb.	25	- -	- -	10·	25,800	1,600
Bones „ - - lb.	15	- -	- -	6·	4,902	168
Bacon.						
Peas, whole, blue - lb.	25	- -	- -	10·	26,880	2,520
„ „ white.						
„ split.						
„ meal.						
Oatmeal - - lb.	12	- -	- -	5·	13,840	700
Flour.						
Potatoes.						
Barley, pearl.						
„ Scotch - lb.	18	- -	- -	7·2	19,123	655
Rice.						
Carrots - - - lb.	10	- -	- -	4·	6,405	213
Turnips - - - lb.	10	- -	- -	4·		
Cabbages - - -	3	- -	- -	1·2		
Onions - - - lb.	15	- -	- -	6·		
Leeks.						
Celery - - sticks	2					
Parsley.						
Thyme - bunches	6					
Mint.						
Marjoram.						
Pepper - - - oz.	4	- -	- -	1·6		
Curry.						
Salt - - - lbs.	5	- -	- -	2·		
Total - -	- -	- -	- -	- -	96,950	5,856

Table No. 112.—ASHTON-UNDER-LYNE.

Charlestown Soup Kitchen.

SOUP.

Quantity per Ration . . . . . 1 pint.
Cost per Ration . . . . .
Nutritive Value per Ration . { Carbon . 581 grains. Nitrogen . 40 grains.

To make 140 gallons, or 1,120 rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	s. d.		Grains.	Grains.
Beef.						
Bones.						
Ham - - - lb.	30	- -	- -	2·7	11,515	210
Bacon - - - lb.						
Peas, whole, blue - lb.	160	- -	- -	14·8	42,336	3,654
„ „ white.						
„ split.						
„ meal - - lb.	10	- -	- -	·9		
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl.						
„ Scotch.						
Rice.						
Carrots - - - lb.	60	- -	- -	5·4	2,073	73
Turnips.						
Cabbage.						
Onions - - - lb.	60	- -	- -	5·4	2,268	73
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - oz.	8					
Curry.						
Salt.						
Total - -	- -	-	- -	- -	58,192	4,010

TABLE No. 113.—ASHTON-UNDER-LYNE.

SEWING CLASSES.

SOUP—BROTH.

QUANTITY per Ration . . . . . 1 pint.
COST per Ration . . . . . . 0·48*d.*
NUTRITIVE VALUE per Ration . { Carbon . 328 grains. / Nitrogen . 20 grains.

To make 140 gallons, or 1,120 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef - - - lb.	96	0 4	37 4	8·57	22,065	1,383
Bones - - - lb.	16			1·4	1.096	33
Bacon.						
Peas, whole, blue.						
„ „ white.						
„ split.						
„ meal - - lb.	20	21/ 240lb. 1·05*d.* lb.	1 9	1·8	4,838	453
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl.						
„ Scotch.						
Rice.						
Carrots - - - lb.	28	10/ 240 lb.	1 2	2·5	4,830	161
Turnips.						
Cabbage and greens -	60	0 0½	2 6	5·35		
Onions - - - lb.	40	12/6 240lb. 0·62*d.* lb.	2 0¾	3·6		
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - -	- -	- -	0 6			
Curry.						
Salt - - - -	- -	- -				
TOTAL - -	- -	- -	45 3¾	- -	32,829	2,230

TABLE No. 114.—ASHTON-UNDER-LYNE.

SEWING SCHOOLS.

PEA SOUP.

QUANTITY per Ration . . . . . 1 pint.
COST per Ration . . . . . . 0·44*d.*
NUTRITIVE VALUE per Ration . { Carbon . 549 grains. / Nitrogen . 39 grains.

To make 140 gallons, or 1,120 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef.						
Bones.						
Ham, reckoned as meat - - - lb.	30	0 5	12 6	2·7	7,085	440
Bacon - - - lb.	30	0 4	10 0	2·7	11,515	210
Peas, whole, blue lb.	120	0 1¼	12 6	10·8	39,022	2,721
„ „ white.						
„ split.						
„ meal - - lb.	20	- -	2 3	1·8	4,838	453
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl.						
„ Scotch.						
Rice.						
Carrots - - - lb.	28	- -	1 2	2·5	962	35
Turnips.						
Cabbage.						
Onions - - - lb.	40	- -	2 0¾	3·6	1,480	50
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram - - -	- -	- -	0 6			
Pepper - - - -	- -	- -				
Curry.						
Salt - - - -	- -	- -				
TOTAL - -	- -	- -	40 11¾	- -	54,902	3,909

Table No. 115.—STOCKPORT.

Brinksway Soup Kitchen.

PEA SOUP.

Quantity per Ration . . . . . . 1 pint.
Cost per Ration. . . . . . . 0·4*d*.
Nutritive Value per Ration { Carbon . 446 grains.
Nitrogen . 34 grains.

To make 80 gallons, or 640 rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations. Quantity.	Per 100 Rations. Carbon.	Per 100 Rations. Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Beef - - - lb.	20½	0 5	10 2½	3·2	9,256	512
Bones, do. - - lb.	2			·3	234	8
Ham.						
Bacon.						
Peas, whole, blue } lb. " " white }	63	0 1¼	6 7	10·	26,880	2,520
" split.						
" meal.						
Oatmeal.						
Flour - - - lb.	18	0 2	3 0	2·97	7,950	357
Potatoes.						
Barley, pearl.						
" Scotch.						
Rice.						
Carrots.						
Turnips.						
Cabbage.						
Onions - - - lb.	5	0 0½	0 2½	·75	315	10
Leeks - - - -	- -	- -	1 1			
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - -						
Curry.						
Salt - - - - -						
Total - -	- -	- -	21 1	- -	44,635	3,407

Table No. 116.—STOCKPORT.

Edgeley District Relief.

SOUP.—Scotch Broth.

Quantity per Ration . . . . . . 1 quart.
Cost per Ration. . . . . . . 1·1*d*.
Nutritive Value per Ration { Carbon . 702 grains.
Nitrogen . 35 grains.

To make 120 gallons, or 480 rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations. Quantity.	Per 100 Rations. Carbon.	Per 100 Rations. Nitrogen.
		s. d.	*s. d.*		Grains.	Grains
Beef - - - lb.	75	0 5	37 6	15·6	40,248	2,496
Bones, do. - - lb.	15			3·1	2,427	74
Ham.						
Bacon.						
Peas, whole, blue.						
" " white.						
" split.						
" meal.						
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl - lb.	40	0 1·35	6	8·33	22,133	759
" Scotch.						
Rice.						
Carrots - - - lb.	25	0 0·24	0 6	5·2	5,460	182
Turnips - - lb.	85	0 0·13	0 6	7·3		
Cabbage.						
Onions - - - lb.	2	- -	0 1½	·4		
Leeks.						
Celery.						
Parsley						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - -	- -	- -	1 0			
Curry.						
Salt - - - -						
Total - -	- -	- -	44 1½		70,268	3,511

TABLE No. 117.—STOCKPORT.

EDGELEY DISTRICT RELIEF.

SCOTCH BROTH.—(1863.)

QUANTITY per Ration . . . . . 1 pint.
COST per Ration . . . . . . 0·88*d.*
NUTRITIVE VALUE per Ration . { Carbon . 457 grains.
{ Nitrogen . 27 grains.

To make 60 gallons, or 480 rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	s. d.		Grains.	Grains.
Beef - - - lb.	65	0 5	31 3	13·54	34,933	2,166
Bone - - - lb.	10			2·08	1,535	41
Cows' head meat - lb.	7	- -	2 6	1·46	3,766	233
" " bone - lb.	3			·62	463	12
Peas, whole, blue - lb.						
" " white.						
" split - - lb.						
" meal.						
Oatmeal.						
Flour.						
Potatoes.						
Barley - - - lb.	8	0 2½	1 8	1·66	4,426	152
" Scotch.						
Rice - - - lb.	7	0 1¾	1 0	1·52	3,897	101
Carrots - - - lb.	4	- -	0 2	·82	322	12
Turnips - - lb.	4	- -	0 2	·93	184	10
Celery - - - lb.	1	- -	0 4			
Parsley - - - lb.	½	- -	0 2	1·56	655	21
Greens, chopped fine lb.	6	- -	0 4			
Onions.						
Leeks.						
Pepper.						
Curry.						
Salt - - - lb.	2½	- -	0 1			
	- -	- -	37 8	- -	50,181	2,748
4½ lbs. of dripping taken out and sold -	- -	- -	2 3	- -	5,000	
TOTAL - -	- -	- -	35 5	- -	45,181	

TABLE No. 118.—STOCKPORT.

EDGELEY DISTRICT RELIEF.

BROTH.—(1863.)

QUANTITY per Ration . . . . 1 pint.
COST per Ration . . . . . 0·67*d.*
NUTRITIVE VALUE per Ration { Carbon . 404 grains.
{ Nitrogen . 26 grains.

To make 60 gallons or 480 rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	s. d.		Grains.	Grains.
Beef - - - lb.	65	0 5	31 3	13·54	34,933	2,166
Bone - - - - lb.	10			2·08	1,535	41
Meat, ox head - lb.	7	- -	2 6	1·46	3,766	233
Bone - - - lb.	3			·62	463	12
Bacon.						
Ham.						
Peas, whole, blue.						
" white.						
" split.						
" meal.						
Oatmeal - - lb.	2	0 2	0 4	·42	1,162	59
Flour.						
Potatoes.						
Barley, pearl.						
" Scotch.						
Rice - - - lb.	3	0 2	0 6	·62	1,666	43
Carrots - - - lb.	10	- -	0 4	2·08	798	29
Turnips - - - lb.	12	- -	0 4	2·5	560	35
Onions, fried brown, lb.	8	- -	0 8	1·7	545	25
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - oz.	6	0 1	0 6	1·25		
Salt - - - lb.	2½	- -	0 1	·5		
	- -	- -	36 10	- -	45,428	2,641
4½ lbs. of dripping taken out and sold -	- -	- -	2 3	- -	5,000	
TOTAL - -	- -	- -	34 7	- -	40,428	

TABLE No. 119.—STOCKPORT.

EDGELEY DISTRICT RELIEF.

PEA SOUP.

QUANTITY per Ration . . . . . . 1 quart.
COST per Ration . . . . . . 1·3*d*.
NUTRITIVE VALUE per Ration . { Carbon . 1,300 grains.
{ Nitrogen . 81 grains.

To make 70 gallons, or 280 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Beef - - - lb.	42½	0 5	20 10	15·1	38,958	2,416
Bones - - - lb.	7½			2·7	2,114	65
Ham.						
Bacon.						
Peas, whole, blue lb.	50	6/6 63lbs. 1¼*d*. lb.	5 2½	18·	48,384	4,536
,, ,, white lb.						
,, split.						
,, meal.						
Oatmeal.						
Flour - - - lb.	6	0 2	1 0	2·1	5,870	252
Potatoes.						
Barley, pearl - lb.	25	0 1⅓	2 9½	9·	23,904	819
,, Scotch.						
Rice.						
Carrots.						
Turnips.						
Cabbage.						
Onions - - - lb.	6	0 0½	0 3	2·1	840	28
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - -	- -	- -	3			
Curry.						
Salt - - - -	- -	- -				
TOTAL - -	- -	- -	30·4		130,070	8,116

TABLE No. 120.—STOCKPORT.

EDGELEY DISTRICT RELIEF.

PEA SOUP.—(1863.)

QUANTITY per Ration . . . . . 1 quart.
COST per Ration . . . . . . 0·95*d*.
NUTRITIVE VALUE per Ration { Carbon . . 662 grains.
{ Nitrogen . 51 grains.

To make 60 gallons, or 480 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Beef - - - lb.	65	0 5	31 3	13·54	34,933	2,166
Bone - - - lb.	10			2·08	1,535	41
Cows' head meat - lb.	7	- -	2 6	1·46	3,766	233
Bone - - - lb.	3			·62	463	12
Peas, whole, blue lb.	50	0 1	4 2	10·4	27,955	2,620
,, ,, white.						
,, split.						
,, meal.						
Oatmeal.						
Flour - - - lb.	1	- -	0 2	·31	557	25
Potatoes - - lb.	5	- -	0 2½	1·64	790	25
Carrots - - lb.	2	- -	0 1	·42	161	6
Turnips - - lb.	3	- -	0 1	·62	138	8
Onions - - - lb.	8	0 1	0 8	1·7	545	25
Celery - - - oz.	8	- -	0 2	1·6		
Mint, dried - - oz.	2	- -	0 1	·42		
Pepper - - - oz.	5	0 1	0 5	1·04		
Salt - - - lb.	2½	- -	0 1	·5		
Milk, new - - pints	4	0 1¼	0 5	·83	435	35
	- -	- -	40 3½	- -	71,278	5,196
4½ lbs. of dripping taken out and sold -	- -	- -	2 3	- -	5,000	
TOTAL - -	- -	- -	33 0½	- -	66,278	

APPENDIX.
V. The Cotton Famine.
3. Economics of diet.
Supplement to Dr. E. Smith's Report.
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Soup.

TABLE No. 121.—STOCKPORT.

KINGSTON MILL.

PEA SOUP.

QUANTITY per Ration	1 pint.
COST per Ration	0·54*d.*
NUTRITIVE VALUE per Ration . Carbon .	587 grains.
Nitrogen .	46 grains.

To make 50 gallons, or 400 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. d.	*s. d.*		Grains.	Grains.
Beef - - -	lb.	22	0 5½	11 5½	5·5	14,190	880
Bones, do. - -	lb.	3			·75	588	18
Ham.							
Bacon.							
Peas, whole, blue	lb.	55	0 1¼	5 9	13·75	36,960	3,465
,, ,, white	lb.						
,, split.							
,, meal.							
Oatmeal.							
Flour - - -	lb.	10	0 2	1 8	2·5	6,640	300
Potatoes.							
Barley, pearl.							
,, Scotch.							
Rice.							
Carrots.							
Turnips.							
Cabbage.							
Onions - - -	lb.	4	- -	0 2	1·	420	14
Leeks.							
Celery.							
Parsley.							
Thyme.							
Mint - - -	-	- -					
Marjoram - - -	-						
Pepper - - -	oz.	4	0 1	0 7	1·		
Curry.							
Salt - - -	lb.	4			1·		
TOTAL - -		- -	- -	19 7½	- -	58,798	4,677

TABLE No. 122.—STOCKPORT.

LANCASHIRE HILL SOUP KITCHEN.

SOUP.

QUANTITY per Ration	1 quart.
COST per Ration	1·36*d.*
NUTRITIVE VALUE per Ration Carbon .	1,136 grains.
Nitrogen .	84 grains.

To make 80 gallons, or 320 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. d.	*s. d.*		Grains.	Grains.
Beef - - -	lb.	45	0 5	25 0	14·	36,120	2,240
Bones - - -	lb.	15			4·66	3,648	112
Ham.							
Bacon.							
Peas, whole, blue.							
,, ,, white	lb.	70	7/6 68 lbs. 1·33*d.* lb.	7 9	21·9	59,100	5,530
,, split.							
,, meal.							
Oatmeal.							
Flour - - -	lb.	8	0 2	1 4	2·5	7,390	300
Potatoes.							
Barley, pearl.							
,, Scotch.							
Rice.							
Carrots - - -	lb.	10	5*s.* 240lbs.	0 2½	3·1	7,350	245
Turnips - - -	lb.	10	20*s.* ton.	0 1½	3·1		
Cabbage.							
Onions - - -	lb.	36	- -	1 6	11·2		
Leeks.							
Celery.							
Parsley.							
Thyme.							
Mint.							
Marjoram.							
Pepper - - -	-	- -	- -	0 5			
Curry.							
Salt - - -	-	- -	- -				
TOTAL - -		- -	- -	36 4	- -	113,608	8,427

TABLE No. 123.—STOCKPORT.

LANCASHIRE HILL SOUP KITCHEN.

SOUP—BARLEY BROTH.

QUANTITY per Ration . . . . . 1 quart.
COST per Ration . . . . . 1·64*d.*
NUTRITIVE VALUE per Ration { Carbon . 936 grains.
{ Nitrogen . 45 grains.

To make 80 gallons, or 320 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations. Quantity.	Per 100 Rations. Carbon.	Per 100 Rations. Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Beef - - - lb.	60	0 5	33 4	18·72	48,375	3,000
Bones, do. - - lb.	20			6·24	4,688	150
Ham.						
Bacon.						
Peas, whole, blue.						
" " white.						
" split.						
" meal.						
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl - lb.	40	0 2½	8 4	12·5	33,200	1,138
" Scotch.						
Rice.						
Carrots - - - lb.	10	5*s.* 240lbs.	0 2½	3·1	7,350	245
Turnips - - - lb.	10	20*s.* ton.	0 1½	3·1		
Cabbage.						
Onions - - - lb.	36	0 0½	1 6	11·2		
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - -	- -	- -	0 5			
Curry.						
Salt - - - -	- -	- -				
TOTAL - -	- -	- -	43 11	- -	93,613	4,533

TABLE No. 124.—STOCKPORT.

PORTWOOD SOUP KITCHEN.

SOUP.

QUANTITY per Ration . . . . . 1 quart.
COST per Ration . . . . . . 1·67*d.*
NUTRITIVE VALUE per Ration . { Carbon . 1,795 grains.
{ Nitrogen . 144 grains.

To make 115 gallons, or 460 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations. Quantity.	Per 100 Rations. Carbon.	Per 100 Rations. Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Beef or pork, offs. and heads - - lb.	63	0 4	33 4	13·7	35,475	2,200
Bones - - - lb.	31			6·73	5.286	162
Ham.						
Bacon.						
Peas, whole, blue - lb.	200	0 1½	25 0	43·5	116,968	10.962
" " white.						
" split.						
" meal.						
Oatmeal - - lb.	35	0 1½	4 4½	7·6	21,036	1,064
Flour.						
Potatoes.						
Barley, pearl.						
" Scotch.						
Rice.						
Carrots.						
Turnips.						
Cabbage.						
Onions - - - lb.	8	0 0¾	0 6	1·74	735	25
Leeks - - - lb.						
Celery.						
Parsley - - - -	- -	- -	1 0			
Thyme - - - -						
Mint - - - -						
Marjoram - - -						
Pepper - - - -	- -					
Curry.						
Salt - - - -	- -					
TOTAL - -	- -	- -	64 2½	- -	179,500	14,411

TABLE No. 125.—STOCKPORT.

ST. MARY'S SOUP KITCHEN.

PEA SOUP.

QUANTITY per Ration . . . . . . 1 pint.
COST per Ration . . . .
NUTRITIVE VALUE per Ration . { Carbon . 639 grains. Nitrogen . 54 grains.

To make 110 gallons, or 880 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	s. d.		Grains.	Grains.
Beef - - - - lb.	43	- -	- -	4·88	12,590	780
Bones - - - - lb.	7	- -	- -	·8	586	19
Ham.						
Bacon.						
Peas, whole, blue - lb.	140	7/6 63lbs.	- -	16·	43,808	1,032
,, ,, white						
,, split.						
,, meal - - lb.	22	- -	- -	2·61	6,988	655
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl.						
,, Scotch.						
Rice.						
Carrots.						
Turnips.						
Cabbage.						
Onions.						
Leeks.						
Celery.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper.						
Curry.						
Salt.						
TOTAL - -	- -	- -	- -	- -	63,972	5,486

TABLE No. 126.—STOCKPORT.

MESSRS. THOMAS THORNELEY & CO'S. MILL.

PEA SOUP.

QUANTITY per Ration . . . . . 1 pint.
COST per Ration . . . . . . 0·3*d.*
NUTRITIVE VALUE per Ration { Carbon . 371 grains. Nitrogen . 58 grains.

To make 36 gallons, or 288 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	s. d.		Grains.	Grains.
Beef - - - lb.	8	0 5	3 11½	2·8	7,224	448
Bones, say - - lb.	1½			·5	392	12
Ham.						
Bacon.						
Peas, whole, blue - } lb.	18	0 1¼	1 10½	6·24	16,800	1,575
,, ,, white }						
,, split.						
,, meal - - lb.	12	0 1½	1 6	4·2	11,289	1,058
Oatmeal.						
Flour.						
Potatoes.						
Barley, pearl.						
,, Scotch.						
Rice.						
Carrots.						
Turnips.						
Cabbage.						
Onions - - lb.	8	- -	0 4	2·8	1,470	49
Leeks - - - lb.	2	- -	- -	·7		
Celery - - - lb.						
Parsley.						
Thyme.						
Mint.						
Marjoram.						
Pepper - - - oz.	2	- -	0 7	·7		
Curry.						
Salt.						
TOTAL - -	- -	- -	8 3	- -	37,175	3,140

TABLE No. 127.—MANCHESTER.

SIR ELKANAH ARMITAGE AND SONS.—New Institution, Pendleton.

POTATO HASH.

QUANTITY per Ration . . . 1 pint.	NUTRITIVE VALUE	Carbon . 911 grains.
COST . . per Ration . . . 0·9*d*.		Nitrogen . 33 grains.

To make 272 pints or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - -	lb.	252	11 6	11 6	92·6	70,376	2,222
Beef - - -	lb.	15¾	0 4½	6 9	5·8	14,964	928
Bones, ⅛th - -	lb.	2¼	- -	- -	·9	704	21
Onions - - -	lb.	24	11½*d*. 20 lbs.	1 8	12·1	5,080	169
Pepper - - - Salt - - -		- -	- -	0 4			
TOTAL - - -		- -	- -	20 3	- -	91,124	3,350

TABLE No. 128.—MANCHESTER.

ARDWICK COOKING KITCHEN (Miss Hilton).

POTATO HASH.

QUANTITY per Ration . . . 1 pint.	NUTRITIVE VALUE	Carbon . 1,269 grains.
COST . . per Ration . . . 1·34*d*.		Nitrogen 50 grains.

To make 120 pints or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - -	lb.	140	0 0½ lb. 10/6 240 lbs.	6 0	116·6	88,516	2,798
Meat (legs) - -	lb.	16	0 5	6 8	13·3	34,400	2,133
Bones (no).							
Onions - - -	lb.	6	0 0¾	0 4½	5·	2,100	70
Carrots - - -	lb.	6	5/0 240 lbs.	0 2	5·	1,920	70
Pepper - - -	oz.	2	0 1	0 2	1·66		
Salt - - -	lb.	2	0 0¼	0 0½	1·66		
TOTAL - - -		- -	- -	13 5	- -	126,936	5,041

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Details of Dietaries.

Public Establishments.

Hash.

TABLE No. 129.—MANCHESTER.

MR. BIRCH'S SEWING CLASSES, 220, City Road.

POTATO HASH.

QUANTITY per Ration . . .	1 pint.	NUTRITIVE VALUE	Carbon .	788 grains.
COST . . per Ration . . .	0·98*d.*		Nitrogen .	34 grains.

To make 160 pints or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - -	lb.	100	10 6	4 2	62·5	47,500	1,500
Beef (neck) - -	lb.	18½	0 5	8 4	11·5	29,670	1,840
Bones - - -	lb.	1½			1·	748	20
Onions - - -	lb.	3½	0 1	0 3½	2·18	910	30
Pepper - - -	oz.	2	0 1	0 2	1·2		
Salt - - - -	lb.	2	0 0¼	0 0½	1·2		
TOTAL - - -		- -	- -	13 0	- -	78,828	3,390

TABLE No. 130.—MANCHESTER.

MR. BIRCH'S INSTITUTE FOR THE UNEMPLOYED.

POTATO HASH.

QUANTITY per Ration . . .	1 pint.	NUTRITIVE VALUE	Carbon .	1,701 grains.
COST . . per Ration . . .	1·9*d.*		Nitrogen	74 grains.

To make 160 pints or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - -	lb.	252	12 0	12 0	157·5	119,700	3,768
Beef - - - -	lb.	30	0 5	12 6	18·7	48,375	3,000
Bones (no).							
Onions - - -	lb.	8	0 1	0 8	5·	2,100	70
Pepper - - -	oz.	4	1 5 lb.	0 4¼	2·5		
Salt - - - -	lb.	4	1 0 cwt.	0 0¾	2·5		
TOTAL - - -		- -	- -	25 7	- -	170,175	7,468

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Details of Dietaries.

Public Establishments.

Hash.

TABLE No. 131.—MANCHESTER.

MR. COOKE'S TWIST COMPANY, Oxford Road.

POTATO HASH.

QUANTITY per Ration . . . 1 pint.	NUTRITIVE VALUE	Carbon	. 1,269 grains.
COST . . per Ration . . . 1·42*d.*		Nitrogen	. 50 grains.

To make 120 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - - lb.	140	11/6 240 lbs.	6 5	116·6·	88,516	2,798
Meat - - - - lb.	16	0 5	6 8	13·33	34,400	2,133
Bones, says almost without.						
Onions - - - lb.	6	- - -	0 10	5·	2,100	70
Carrots - - - lb.	6			5·	1,920	70
Pepper - - - oz.	2	- - -	0 4			
Salt - - - - lb.	2					
TOTAL - - -	- - -	- - -	14 3	- -	126,936	5,071

TABLE No. 132.—MANCHESTER.

DISTRICT PROVIDENT SOCIETY SEWING SCHOOL.

POTATO HASH.

QUANTITY per Ration . . 1 pint.	NUTRITIVE VALUE	Carbon	- 1,032 grains.
COST . . per Ration . . 1·19*d.*		Nitrogen	39 grains.

To make 156 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - - lb.	160	11½*d.* 20 lbs.	7 8	102·5	77,900	2,460
Beef - - - - lb.	14	0 6	7 0	9·	23,220	1,440
Bone.						
Onions - - - lb.	8	0 1	0 8	5·1	2,140	71
Pepper and salt - -	- -	- -	0 2			
TOTAL - -	- -	- -	15 6	- -	103,260	3,971

TABLE No. 133.—MANCHESTER.

GAYTHORN COOKING DEPÔT.

POTATO PIE.

QUANTITY per Ration . ,	NUTRITIVE VALUE	Carbon	. 878 grains.
COST . . per Ration . . 1·16*d.*		Nitrogen	33 grains.

To make 160 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes . - - lb.	70	1*s.* 20 lbs.	3 6	43·75	33,250	1,064
Meat, mutton - - lb.	17¼	0 5½	9 2	10·78	31,272	1,509
Bone, $\frac{1}{7}$th - - - lb.	2¾			1·7	1,321	40
Bacon.						
Dripping - - - lb.	2	0 6	1 0	1·25	6,650	
Flour - - - lb.	8½	0 2	1 8	5·31	14,090	640
Onions - - - lb.	5	1*s.* 20 lbs.	0 3	3·1	1,300	43
Pepper and salt, say -	- -	- -	0 2			
Water - - - pints	6					
TOTAL - -	- -	- -	15 9	- -	87,883	3,296

TABLE No. 134.—MANCHESTER.

ST. JUDE'S.

POTATO HASH.

QUANTITY per Ration . . 1½ pints. || NUTRITIVE VALUE { Carbon . 1,005 grains.
COST . . per Ration . . 1·6*d*. || { Nitrogen 55 grains.

To make 80 gallons, or 430 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - -	lb.	400	10½*d.* 20 lbs.	21 0	93·	70,680	2,231
Beef - - -	lb.	38	0 3½	14 7	9·	23,220	1,440
Bones - - -	lb.	12			2·8	2.152	67
Onions - - -	lb.	40	0 0⅜	1 6	9·3	3,920	130
Carrots - - -	lb.	8			1·8	626	26
Pepper, salt, parsley, and celery - - - -		- -	- -	1 0			
TOTAL - -		- -	- -	38 1	- -	100,598	3,894

TABLE No. 135.—MANCHESTER.

ST. PHILIP'S DISTRICT.

POTATO HASH.

QUANTITY per Ration . . . 1 pint. || NUTRITIVE VALUE { Carbon . 1,229 grains.
COST . . per Ration . . . 1·05*d*. || { Nitrogen . 34 grains.

To make 22 pints or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - -	lb.	25	- - -	1 3	113·5	86,330	2,726
Beef.							
Bone.							
Bacon - - -	lb.	1¼	0 4	0 5	7·81	33,309	610
Onions - - -	lb.	1¼	0 1	0 1¼	7·81	3,266	110
Flour, little.							
Pepper and salt - -		- - -	- - -	0 2			
TOTAL - - -		- - -	- - -	1 11¼	- -	122,905	3,446

TABLE No. 136.—MANCHESTER.

MESSRS. STIRLING.

POTATO HASH.—FOR MEN.

QUANTITY per Ration . . 1 lb. || NUTRITIVE VALUE { Carbon . 810 grains.
COST . . per Ration . . 1·04*d*. || { Nitrogen 34 grains.

To make 120 lbs. or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - -	lb.	80	11¼*d.* 20 lbs.	3 9	66·6	50,616	1,598
Beef - - -	lb.	15	0 5	6 3	10·8	27,864	1,728
Bone, ⅐th - -	lb.	2			1·7	1,321	40
Onions - - -	lb.	3½	0 0¾	0 2½	3·	1,260	52
Pepper - - -	oz.	2	0 1	0 2	1·7		
Salt, &c. - - -	lb.	2		0 1	1·7		
TOTAL - -		- -	- -	10 5½		81,061	3,418

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

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Details of Dietaries.

Public Establishments.

Hash.

TABLE No. 137.—MANCHESTER.

MESSRS. STIRLING.

POTATO HASH.—FOR WOMEN.

QUANTITY per Ration	. . 1 lb.	NUTRITIVE VALUE	Carbon .	698 grains.
COST . . per Ration	. . 0·86*d*.		Nitrogen	28 grains.

To make 230 lbs. or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Potatoes - - - lb.	140	11¼*d*. 20 lbs.	6 6¾	60·8	46,208	1,459
Beef - - - - lb.	19¼	0 5	9 4½	8·3	21,414	1,328
Bones, ⅐th - - lb.	3¼	- -	- -	1·4	1,096	33
Onions - - - lb.	6¼	0 0¾	0 4½	2·7	1,134	38
Pepper - - - oz.	3	0 1	0 3	1·3		
Salt - - - - lb.	3	0 0¼	0 0¾	1·3		
TOTAL -	- -	- -	16 7½		69,852	2,858

TABLE No. 138.—WIGAN.

MESSRS. WM. WOOD AND SON'S FACTORY.

POTATO HASH—IRISH STEW.

QUANTITY per Ration	. . 1 lb. 6 oz.	NUTRITIVE VALUE	Carbon .	1,262 grains.
COST . . per Ration	. . 1·64*d*.		Nitrogen .	60 grains.

To make 7 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Potatoes - - - lb.	8	3/9 84 lbs.	0 4½	114·	86,640	3,736
Beef - - - - lb.	1	0 6	0 6	14·25	37,765	2,280
Bones.						
Onions - - - oz.	5	- -	0 0¼	71·25	1,880	60
Pepper.						
Salt - - - - -	- -	- -	0 0¾			
TOTAL - -	- -	- -	0 11½	- -	126,285	6,076

TABLE No. 139.—PRESTON.

PRESTON RELIEF FUND.

POTATO HASH, OR SCOUSE.

QUANTITY per Ration	. . 1 pint.	NUTRITIVE VALUE	Carbon .	1,329 grains.
COST . . per Ration	. . 1·37*d*.		Nitrogen .	48 grains.

To make 200 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Potatoes - - - lb.	240	- -	11 0	120·	91,200	2.880
Mutton - - - lb.	26	0 4½	11 3	13·	37,713	1,820
Bone - - - - lb.	4			2·	1,566	48
Onions - - - lb.	12	- -	0 5	6·	2,520	84
Pepper - - - oz.	3	- -	0 3	1·5		
Salt - - - - lb.	2	- -	0 0½	1·		
TOTAL - -	- -	- -	22 11½	- -	132,999	4,792

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

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Details of Dietaries.

Public Establishments.

Hash.

TABLE No. 140.—BLACKBURN.

MRS. GLADSTONE'S SOUP KITCHEN.

POTATO HASH, OR SCOUSE.

QUANTITY per Ration . . 1 quart. || NUTRITIVE VALUE { Carbon . 1,753 grains.
COST . . per Ration . . 1·83*d.* || { Nitrogen . 67 grains.
To make 1,300 quarts.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes (flukes) - lb.	{ 9 loads, 2,268	12 0	108 0	174·4	132,544	4,185
Beef, fore-quarters - lb.	206	0 4½	90 0	15·8	40,764	2,528
Bones, $\frac{1}{7}$th - - lb.	34			2·61	2,080	64
Onions.						
Pepper and salt - -	- -	- -	0 9			
TOTAL - -	- -	- -	198 9	- -	175,388	6,777

Potato pie.

TABLE No. 141.—BLACKBURN.

MOTHER'S KITCHEN.

POTATO PIE.

QUANTITY per Ration . . . || NUTRITIVE VALUE { Carbon . 2,884 grains.
COST . . per Ration . . . 3½*d.* || { Nitrogen . 109 grains.
To make 40 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - - lb.	60	1*s.* 20 lbs.	3 0	150·	114,000	3,600
Meat - - - lb.	12	0 5	5 0	30·	77,400	4,800
Bacon - - - lb.	1	0 7	0 7	2·5	11,882	195
Lard - - - lb.	2	0 7	1 2	5·	26,660	
Flour - - - lb.	8	0 1½	1 0	20·	58,520	2,400
Pepper - - - -	- -	- -	0 2			
Salt - - - - -						
TOTAL - -	- -	- -	10 11	- -	288,462	10,995

Hash.

TABLE No. 142.—BLACKBURN.

ST. PETER'S MARRIED MEN'S SCHOOL.

POTATO HASH.

QUANTITY per Ration . . . 1¼ pint. || NUTRITIVE VALUE { Carbon . 1,720 grains.
COST . . per Ration . . . 1·72*d.* || { Nitrogen . 64 grains.
To make 200 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - - lb.	360	10 6	15 9	180·	136,800	4,320
Mutton, breasts, necks lb.	26¼	0 5	12 6	13·12	33,798	2,128
Bone, $\frac{1}{8}$th - - - lb.	3¾			1·87	1,464	33
Onions.						
Pepper - - - -	- -	- -	0 5			
Salt - - - - -						
TOTAL - -	- -	- -	28 8	- -	172,062	6,481

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

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Hash.

TABLE No. 143.—ASHTON-UNDER-LYNE.

SEWING CLASSES.

POTATO HASH.

QUANTITY per Ration . . . 1 pint. ‖ NUTRITIVE VALUE { Carbon . 491 grains.
COST . . per Ration . . . 0·7*d*. ‖ { Nitrogen . 20 grains.

To make 1,120 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes lb.	360	10 6	15 9	32·1	23,416	770
Meat lb.	96	0 5	46 8	8·57	22,133	1,371
Bones ($\frac{1}{7}$th) lb.	16			1·4	1,096	33
Onions lb.	40	- -	2 0	3·56	1,500	50
Carrots lb.	28	- -	0 10	2·5	960	35
Pepper	- -	- -	0 9			
Salt						
TOTAL	- -	- -	66 0	- -	49,105	2,059

TABLE No. 144.—STOCKPORT.

EDGELEY DISTRICT RELIEF.

POTATO HASH.

QUANTITY per Ration . . . 1 quart. ‖ NUTRITIVE VALUE { Carbon . 1,695 grains.
COST . . per Ration . . . 1·7*d*. ‖ { Nitrogen . 63 grains.

To make 70 gallons, or 280 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes lb.	480	10/6 240 lbs.	21 0	171·4	130,264	4,113
Beef lb.	34	0 5	16 8	12·1	31,218	1,936
Beef bones lb.	6			2·1	1,544	50
Bones lb.	12	0 1	1 0	6·4	5,011	153
Onions lb.	10	0 0¾	0 7½	3·5	1,470	49
Pepper oz.	5	0 1	0 5	1·8		
Salt lb.	3	0 0¼	0 0¾	1·07		
TOTAL	- -	- -	39 9¼	- -	169,507	6,301

TABLE No. 145.—STOCKPORT.

EDGELEY DISTRICT RELIEF.

POTATO HASH.

QUANTITY per Ration . . . 1 pint. ‖ NUTRITIVE VALUE { Carbon . 1,137 grains.
COST . . per Ration . . . 1·24*d*. ‖ { Nitrogen . 43 grains.

To make 60 gallons, or 480 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Beef lb.	30	0 5	12 6	6·25	16,125	1,000
Mutton lb.	44	0 5	20 10	9·1	26,399	1,274
Bones lb.	6			1·25	935	25
Potatoes lb.	400	9*d*. 20 lbs.	15 0	83·33	73,266	2,000
Onions lb.	8	0 1	0 8	1·7	545	25
Pepper oz.	6	0 1	0 6	1·25		
Salt lb.	2½	- - -	0 1	·5		
TOTAL	- - -	- - -	49 7	- -	113,270	4,324

TABLE No. 146.—STOCKPORT.

LANCASHIRE HILL SEWING SCHOOL.

POTATO HASH.

QUANTITY per Ration . . . 1 quart.	NUTRITIVE VALUE.	Carbon .	1,767 grains.
COST . . per Ration . . . 2·07*d.*		Nitrogen .	70 grains.

To make 80 gallons, or 320 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - - lb.	500	10*s.* 240lbs.	20 0	156·2	118,750	3,738
Beef - - - - lb.	60	5 0	33 4	18·72	48,375	3,000
Bones - - - lb.	20			6·24	4,894	126
Onions - - - lb.	36	- -	1 6	11·2	4,700	152
Pepper - - - -	- -	- -	0 5			
Salt - - - - -						
TOTAL - -	- -	- -	55 3	- -	176,719	7,016

TABLE No. 147.—STOCKPORT.

PORTWOOD SOUP KITCHEN.

POTATO HASH.

QUANTITY per Ration . . . 1 quart.	NUTRITIVE VALUE	Carbon .	2,038 grains.
COST . . per Ration . . . 2·32*d.*		Nitrogen .	80 grains.

To make 460 quarts or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - - lb.	3½ loads, 885	10 6	36 9	192·4	146,244	4,617
Beef, fore quarters - lb.	96	0 5½	51 4	20·8	53,664	3,328
Bone, $\frac{1}{7}$th - - - lb.	16			3·9	3,053	94
Onions - - - lb.	10	0 0¾	0 7½	2·1	880	29
Pepper and salt - -	- - -	- - -	0 7			
TOTAL - -	- - -	- - -	89 3½	- -	203,821	8,078

TABLE No. 148.—STOCKPORT.

ST. MARY'S SOUP KITCHEN.

POTATO HASH.

QUANTITY per Ration . . . 1 pint.	NUTRITIVE VALUE	Carbon .	769 grains.
COST . . per Ration . . . 0·75*d.*		Nitrogen .	28 grains.

To make 110 gallons, or 880 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - - lb.	3 loads, 740	10/6 240 lbs.	31 6	84·2	63,811	2,021
Meat - - - lb.	42·86	0 5½	22 11	4·86	12,538	770
Bone, $\frac{1}{7}$th - - - lb.	7·14			·8	626	19
Onions.						
Pepper - - - oz.	8	- - -	0 9	·9		
Salt - - - - lb.	4	- - -	- - -	·45		
TOTAL - -	- - -	- - -	55 2	- -	76,975	2,810

TABLE No. 149.—STOCKPORT.

MESSRS. THOS. THORNELEY & CO.'S MILL.

POTATO HASH.

Hash.

QUANTITY per Ration . . . 1 pint. NUTRITIVE VALUE { Carbon . 744 grains.
COST . . per Ration . . . 0·64*d*. { Nitrogen . 25 grains.

To make 36 gallons, or 288 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Potatoes - - - lb.	240	10 6	10 6	83·3	63,233	2,000
Meat - - - lb.	10	0 5	4 2	3·4	9,772	544
Bones.						
Onions - - - lb.	10	0 0¾	0 7½	3·4	1,428	47
Pepper - - - oz.	2	0 1	0 2	·7		
Salt - - - - -	- - -	- - -	0 1			
TOTAL - -	- - -	- - -	15 6½	- -	74,433	2,591

TABLE No. 150.—MANCHESTER.

ARDWICK COOKING KITCHEN.—Miss Hilton.

RICE PUDDING.

Rice pudding.

QUANTITY per Ration . . . 1 pint. NUTRITIVE VALUE { Carbon . 1,445 grains.
COST . . per Ration . . . 1·73*d*. { Nitrogen . 44 grains.

To make 30 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Rice - - - - lb.	12	0 2	2 0	39·6	106,444	2,770
Milk (new) - - pints	12	0 1½	1 6	39·6	21,441	1,701
Sugar - - - lb.	1	0 4	0 4	3·3	9,134	
Dripping - - lb.	1	0 6	0 6	3·3	17,556	
Cinnamon.						
TOTAL - -	- -	- -	4 4	- -	144,575	4,471

TABLE No. 151.—MANCHESTER.

DISTRICT PROVIDENT SOCIETY SEWING SCHOOL.

RICE MILK.

Rice milk.

QUANTITY per Ration . . . 1 pint. NUTRITIVE VALUE { Carbon . 437 grains.
COST . . per Ration . . . 0·43*d*. { Nitrogen . 15 grains.

To make 150 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Rice - - - - lb.	14	0 1¼	1 5½	9·33	25,088	653
Milk (new) - - pints	28	0 1½	3 6	18·66	10,192	802
Sugar - - - lb.	3½	0 4½	1 3¾	2·33	6,458	
Flour - - - lb.	1	0 2¼	0 2¼	·66	1,970	80
TOTAL - -	- -	- -	6 5½	- -	43,708	1,535

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

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Details of Dietaries.

Public Establishments.

Rice milk.

TABLE No. 152.—MANCHESTER.

ST. JUDE'S.

RICE MILK.

QUANTITY per Ration . . . 1½ pints. || NUTRITIVE VALUE { Carbon . 866 grains.
COST . . per Ration . . . 0·94*d*. || { Nitrogen . 33 grains.

To make 80 gallons, or 426 Rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. d.	*s. d.*		Grains.	Grains.
Rice - - - -	lb.	92	0 2	15 4	21·6	58,060	1,514
Milk, skimmed -	pints	184	0 0¾	11 6	43·2	18,921	1,857
Sugar - - -	lb.	15	0 4½	5 7½	3·52	9,688	
TOTAL - -		- -	- -	33 5½	- -	86,669	3,371

TABLE No. 153.—MANCHESTER.

SIR ELKANAH ARMITAGE AND SONS.—New Institution, Pendleton.

RICE MILK.

QUANTITY per Ration . . . 1 pint. || NUTRITIVE VALUE { Carbon . 631 grains.
COST . . per Ration . . . 0·94*d*. || { Nitrogen . 26 grains.

To make 288 pints or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. d.	*s. d.*		Grains.	Grains.
Rice - - - -	lb.	34	0 2	5 8	11·8	31,440	816
Milk, new - -	pints	108	0 1½	13 6	37·1	20,256	1,596
Sugar - - -	lb.	6	0 5	2 6	2·08	5,550	
Flour - - -	lb.	6	0 2	1 0	2·08	5,930	241
TOTAL - -		- -	- -	22 8	- -	63,176	2,653

TABLE No. 154.—STOCKPORT.

BRINKSWAY SOUP KITCHEN.

Barley porridge.

BARLEY PORRIDGE.

QUANTITY per Ration . . . 1 pint. || NUTRITIVE VALUE { Carbon . 893 grains.
COST . . per Ration . . . 0·64*d*. || { Nitrogen . 24 grains.

To make 80 gallons, or 480 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. d.	*s. d.*		Grains.	Grains.
* { Barley (pearl) -	lb.	56	0 1½	7 0	11·66	30,986	1,062
{ Rice - - -	lb.	56	0 1¼	5 10	11·66	31,440	816
Milk (new) -	pints	84	0 1	7 0	27·5	15,015	322
Sugar - - -	lb.	13	0 4	4 4	2·7	7,473	
Flour - - -	lb.	8	0 1½	1 0	1·66	4,426	200
Spice (all) - -	oz.	8	- - -	0 4	1·66		
TOTAL - -		- - -	- - -	25 6	- -	89,340	2,400

* Or all Rice.

TABLE No. 155.—STOCKPORT.

MESSRS. THOMAS THORNELEY AND CO'S. MILL.

RICE MILK.

Rice milk.

QUANTITY per Ration . . 1 pint. ‖ NUTRITIVE VALUE { Carbon . 550 grains.
COST . . per Ration . . 0·47*d*. ‖ { Nitrogen 18 grains.

To make 36 gallons, or 288 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
				s. *d.*		Grains.	Grains.
Rice - - - -	lb.	36	13*s*. cwt., 1·3*d*. lb.	3 11	12·5	33,550	875
Milk, new -	pints	65	- -	5 5	22·5	12,285	967
Treacle - - -	lb.	12	20*s*. cwt., 2·1*d*. lb.	2 1½	4·1	9,184	
TOTAL - -		- -	- -	11 5½	- -	55,019	1,842

TABLE No. 156.—STOCKPORT.

EDGELEY DISTRICT RELIEF.

RICE MILK.

QUANTITY per Ration . . . 1 pint. ‖ NUTRITIVE VALUE { Carbon . 878 grains.
COST . . per Ration . . . 1·07*d*. ‖ { Nitrogen . 30 grains.

To make 60 gallons, or 480 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Rice - - - -	lb.	60	0 1¾	8 9	12·5	33,600	875
Milk, new - -	pints	240	0 1¼	25 0	50·	27,300	2,150
Butter - - -	oz.	16	1*s*. lb.	1 0	3·33	15,318	
Sugar - - -	lb.	20	0 4½	7 6	4· 2	11,625	
Nutmegs - - -	oz.	1½	- -	0 9	·31		
Water - -	pints	90					
TOTAL - -		- -	- -	43 0	- -	87,843	3,025

TABLE No. 157.—PRESTON.

PRESTON RELIEF FUND.

GRUEL—SWEET SOUP.

Sweet soup.

QUANTITY per Ration . . 1 quart. ‖ NUTRITIVE VALUE { Carbon . 1,028 grains.
COST . . per Ration . . 0·58*d*. ‖ { Nitrogen 28 grains.

To make 700 quarts or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Oatmeal - - -	lb.	40	0 1½	5 0	5·71	15,916	805
Barley, Scotch -	lb.	120	0 1·4	14 0	17·1	45,417	1,556
Rice - - - -	lb.	48	11*s*. cwt., 1·17*d*. lb.	4 8	6·85	18,490	478
Sago - - - -	lb.	28	0 2¼	5 3	4·	10,208	7
Treacle - - -	lb.	40	0 1½	5 0	5·71	12,810	
Salt - - - -	lb.	12	- -	0 1½	1·71		
Pimento pepper -	oz.	1½	6*d*. lb.	0 0½	¼		
TOTAL - -		- -	- -	34 1		102,841	2,846

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Details of Dietaries.

Public Establishments.

Porridge.

TABLE No. 158.—STOCKPORT.

MESSRS. THOMAS THORNELEY AND CO'S. MILL.

PORRIDGE.

QUANTITY per Ration . . 1 pint. ‖ NUTRITIVE VALUE { Carbon . 855 grains.
COST . . per Ration . . 0·49*d*. ‖ Nitrogen 29 grains.

To make 36 gallons, or 288 rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Oatmeal - - -	lb.	60	0 1½	7 6	20·8	57,574	2,912
Treacle - - -	lb.	36	- -	6 4½	12·5	28,000	
TOTAL - -		- -	- -	10 10½	- -	85,574	2,912

TABLE No. 159.—MANCHESTER.

ARDWICK COOKING KITCHEN (Miss Hilton).

Tea.

TEA.

QUANTITY per Ration . . 1 pint. ‖ NUTRITIVE VALUE { Carbon . 105 grains.
COST . . per Ration . . 0·5*d*. ‖ Nitrogen . 3 grains.

To make 50 pints or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Tea - - - -	lb.	¼	2 11	0 8¾	8·33	- -	83
Sugar - - -	lb.	¾	- -	0 3¼	2·5	6,920	
Milk - -	pints	2	0 1½	0 3	6·66	3,603	291
TOTAL - -		- -	- -	1 3	- -	10,523	374

TABLE No. 160.—MANCHESTER.

MR. BIRCH'S INSTITUTE FOR THE UNEMPLOYED, 26, City Road.

TEA.

QUANTITY per Ration . . 1 pint. ‖ NUTRITIVE VALUE { Carbon . 89 grains.
COST . . per Ration . . 0·27*d*. ‖ Nitrogen . 2 grains.

To make 160 pints or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Tea - - - -	lb.	8½	2 8	1 4	5·0	- -	50
Sugar - - -	lb.	3¾	0 4	1 3	2·15	6,228	
Milk, new - -	pints	8	0 1½	1 0	5·0	2,770	215
TOTAL - -		- -	- -	3 7	- -	8,998	235

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

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Tea.

TABLE No. 161.—MANCHESTER.

GAYTHORN COOKING DEPÔT.

TEA.

QUANTITY per Ration . Over ½ pint.
COST . . per Ration . 0·9*d*.

NUTRITIVE VALUE { Carbon . 107 grains.
Nitrogen . 2 grains.

To make 17 pints, or 31 rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Tea - - - - oz.	4	3 3 lb.	0 9¾	12·9	- -	130
Sugar - - - lb.	1	0 4	0 4	3·2	8,996	
Milk, new - - - pint	1	0 1½	0 1½	3·2	1,774	140
Water - - pints	16	- -	- -	51·6		
TOTAL - -	- -	- -	1 3¼	- -	10,770	270

TABLE No. 162.—MANCHESTER.

NEW INSTITUTION, PENDLETON.

TEA.

QUANTITY per Ration . . . 1 pint.
COST . . per Ration . . . 1·8*d*.

NUTRITIVE VALUE { Carbon . 394 grains.
Nitrogen . 13 grains.

To make 16 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Tea - - - - oz.	4½	0 3	1 1½	28·13	- -	281
Sugar - - - lb.	1½	0 6	0 9	9·34	25,834	
Milk - - - pints	4	0 1½	0 6	25·	13,650	1,074
TOTAL - -	- -	- -	2 4½	- -	39,484	1,355

TABLE No. 163.—STOCKPORT.

KINGSTON MILL.

TEA.

QUANTITY per Ration . . . 1 pint.
COST . . per Ration . . . 0·39*d*.

NUTRITIVE VALUE { Carbon . 154 grains.
Nitrogen . 4 grains.

To make 50 pints or rations.

FOOD.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Tea - - - - oz.	3¼	0 2¼	0 7½	6·5	- -	65
Sugar - - - lb.	2	0 4	0 8	4·	11,072	
Milk - - - pints	4	0 1	0 4	8·	4,368	344
TOTAL - -	- -	- -	1 7½	- -	15,440	409

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Details of Dietaries.

Public Establishments.

Coffee.

TABLE No. 164.—MANCHESTER.

ARDWICK COOKING KITCHEN.

COFFEE.

QUANTITY per Ration . . . 1 pint. ‖ NUTRITIVE VALUE { Carbon . 123 grains.
COST . . per Ration . . . 0·36*d*. ‖ Nitrogen . 4 grains.

To make 30 pints or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Coffee - - -	oz.	4	1 2 lb.	0 3½	13·32	- -	66
Chicory - - -	oz.						
Sugar - - -	lb	¾	0 4	0 3	2·5	6,920	
Milk, new - -	pints	3	0 1½	0 4½	10·	5,460	430
TOTAL - -		- -	- -	0 11	- -	12,380	496

TABLE No. 165.—MANCHESTER.

MR. BIRCH'S SEWING CLASSES, 220, City Road.

COFFEE.

QUANTITY per Ration . . . 1 pint. ‖ NUTRITIVE VALUE { Carbon . 91 grains.
COST . . per Ration . . . 0·28*d*. ‖ Nitrogen . 1 grain.

To make 160 pints or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Coffee - - -	oz.	26	1 0 lb.	1 7½	16·25	- -	81
Chicory - - -	oz.						
Sugar - - -	lb.	4½	0 4½	1 8¼	2·81	7,750	
Milk - - -	pints	4	0 1½	0 6	2·5	1,364	107
TOTAL - -		- -	- -	3 9¾	- -	9,114	188

TABLE No. 166.—MANCHESTER.

DISTRICT PROVIDENT SOCIETY'S SEWING SCHOOL.

COFFEE.

QUANTITY per Ration . . 1 pint. ‖ NUTRITIVE VALUE { Carbon . 154 grains.
COST . . per Ration . . 0·44*d*. ‖ Nitrogen . 3 grains.

To make 178 pints or rations.

FOOD.		Quantity.	Price.	Total Cost.	Per 100 Rations.		
					Quantity.	Carbon.	Nitrogen.
			s. *d.*	*s.* *d.*		Grains.	Grains.
Coffee - - -	oz.	32	1 2 lb.	2 4	18·	- -	70
Sugar - - -	lb.	7½	0 4½	2 9¾	4·22	11,764	
Milk - - -	pints	12	0 1½	1 6	6·74	3,680	289
TOTAL - -		- -	- -	6 7¾	- -	15,444	359

Table No. 167.—MANCHESTER.

Gaythorn Cooking Depôt.

COFFEE.

Quantity per Ration	. Over ½ pint.	Nutritive Value	Carbon	.	107 grains.
Cost . . per Ration	. 0·4*d*.		Nitrogen	.	2 grains.

To make 17 pints, or 31 rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Coffee - - - oz.	6	- -	- -	19·3	- -	96
Sugar - - - lb.	1	41*s.* cwt. 0 4	- -	3·22	8,996	
Milk, new - - - pint	1	0 1½	0 1½	3·22	1,774	140
Water - - pints	16	- -	- -	51·1		
Total - -	- -	- -	1 0	- -	10,770	236

Table No. 168.—MANCHESTER.

The New Institution, Pendleton.

COFFEE.

Quantity per Ration	. . ½ pint.	Nutritive Value	Carbon	.	152 grains.
Cost . . per Ration	. . 0·8*d*.		Nitrogen	.	5 grains.

To make 2 quarts, or 8 rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Coffee - - - oz.	3	1 8 lb.	0 3½	37·5	- -	187
Sugar - - - oz.	5	0 6 lb.	0 2	62·5	10,862	
Milk - - - - pint	⅔	0 1½	0 1	8·25	4,425	354
Total - -	- -	- -	0 6½	- -	15,287	541

Table No. 169.—MANCHESTER.

Messrs. Stirling's Factory.

COFFEE.—For Men.

Quantity per Ration	. . 1 pint.	Nutritive Value	Carbon	.	62 grains.
Cost . . per Ration	. . 0·23*d*.		Nitrogen	.	·8 grains.

To make 100 pints or rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. *d.*	*s.* *d.*		Grains.	Grains.
Coffee - - - lb.	¾	1 4	1 0	¾	- -	60
Chicory - - - lb.	½	0 4	0 2	½	- -	20
Sugar - - - lb.	2¼	0 4	0 9	2¼	6,228	
Total - -	- -	- -	1 11	- -	6,228	80

Appendix.

V. The Cotton Famine.

3. Economies of diet.

Supplement to Dr. E. Smith's Report.

Details of Dietaries.

Public Establishments.

Coffee.

Table No. 170.—WIGAN.

Messrs. Wm. Woods and Son's Factory.

COFFEE.

Quantity per Ration . . . 1 quart. || Nutritive Value { Carbon . 597 grains.
Cost . . per Ration . . . 1·28*d*. || { Nitrogen . 9 grains.

To make 48 quarts or rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Coffee - - - oz.	22	1 4	1 10	45·75	- -	228
Chicory - - - oz.	3	0 4	0 1	6·25	- -	8
Sugar - - - lb.	9	0 4½	3 4½	18·56	50,760	
Milk, new - - pints	8	0 1¼	0 10	16·64	8,940	716
Total - - -	- - -	- - -	6 1½	- -	59,700	952

Table No. 171.—BLACKBURN.

Mrs. Gladstone's Kitchen.

COFFEE.

Quantity per Ration . . . 1 quart. || Nutritive Value { Carbon . 253 grains.
Cost . . per Ration . . . 0·8*d*. || { Nitrogen . 4 grains.

To make 600 quarts or rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d:	*s. d.*		Grains.	Grains.
Coffee - - - lb.	12	1 5	17 0	2·	- -	85
Chicory - - - lb.	5	0 4½	1 10½	·83	- -	12
Sugar - - - lb.	45	0 4½	16 10½	7·5	20,760	
Milk, new - - pints	50	0 1	4 2	8·33	4,550	358
Total - - -	- - -	- - -	39 11	- -	25,510	445

Table No. 172.—STOCKPORT.

Heaton Reddish School.

COFFEE.

Quantity per Ration . . . 1 pint. || Nutritive Value { Carbon . 124 grains.
Cost . . per Ration . . . 0·37*d*. || { Nitrogen . 2 grains.

To make 108 pints or rations.

Food.	Quantity.	Price.	Total Cost.	Per 100 Rations.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*		Grains.	Grains.
Coffee - - - oz.	14 }	0 1	1 2 {	13·	- -	65
Chicory - - - oz.	4 }			3·7	- -	10
Sugar - - - lb.	4	0 4½	1 10	3·7	10,380	
Milk - - pints	4	0 1	0 4	3·7	2,047	159
Total - - -	- -	- -	3 4	- -	12,427	234

Blackburn.

TABLE 173.—FOOD FOR THE SICK.—BLACKBURN.

SICK KITCHEN.

Beef Tea.

Meat, without bone . . .	1 lb.
Water	2 pints.

Mince the meat and soak it in cold water during 1 or 2 hours, then boil during 2 or 3 hours and strain.

Arrow Root.

Arrow root	2 table spoonsful.
Water to make	1 quart.

Sago.

Sago	$\frac{1}{2}$ lb.
Water to make	1 quart.

Indian Corn.

Indian corn meal . . .	$\frac{1}{2}$ lb.
Water	2 quarts.
Allspice.	
Sugar	

Boil 5 minutes.

Preston

TABLE No. 174.—FOOD FOR THE SICK.—PRESTON.

SICK KITCHEN.

Beef Tea.

Beef (neck), without bone . .	1 lb.

Mince, soak, and stir well in 1$\frac{1}{2}$ pints of cold water during 1 hour. Add $\frac{1}{2}$ pint of good beef broth. Boil 1 hour and strain. When cold take off the fat.

Arrow Root.

Arrow root	1 table spoonful.
Milk (new)	$\frac{1}{2}$ pint.
Water	$\frac{1}{2}$ pint.
Spice and sugar.	

Sago.

Sago	$\frac{3}{4}$ of a pint.
Water	5 quarts.
Cinnamon and mixed spices.	
Sugar.	

Gruel.

Barley	1 pint.
Water	5 quarts.
Spice and sugar.	

Boil to 4 quarts.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E Smith's Report.

Proposed Dietaries.

Breakfast.

Milk porridge.

SEPARATE MEALS FOR AN ADULT COOKED AT HOME; RETAIL PRICES.

BREAKFAST.—TO COST NOT MORE THAN $1\frac{1}{2}d.$

TABLE No. 175.

General Character : MILK PORRIDGE.—COST, $1\frac{1}{8}d.$

ACTUAL NUTRITIVE VALUE { Carbon . 1,300 grains. Nitrogen . 77 grains.

REQUIRED QUANTITY { Carbon . 1,500 grains. Nitrogen . 70 grains.

FOR WOMEN, $\frac{1}{10}$ LESS.

Food.		Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Skimmed milk - - -	pint	1	4	438	43
Oatmeal - - - -	oz.	2	$1\frac{3}{4}$	346	$17\frac{1}{2}$
Bread - - - -	oz.	3	$2\frac{1}{4}$	369	17
Fat - - - -	oz.	$\frac{1}{2}$	$1\frac{1}{4}$	147	
			8) $9\frac{1}{4}$		

TABLE No. 176.

General Character : MILK PORRIDGE.—COST, $1\frac{1}{4}d.$

ACTUAL NUTRITIVE VALUE { Carbon . 1,478 grains. Nitrogen . 80 grains.

REQUIRED QUANTITY { Carbon . 1,500 grains. Nitrogen . 70 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Skimmed milk - - -	pint	$\frac{3}{4}$	3	329	32
Oatmeal - - - -	oz.	2	$1\frac{3}{4}$	346	$17\frac{1}{2}$
Bread - - - -	oz.	$5\frac{1}{3}$	4	656	$30\frac{1}{2}$
Fat - - - - -	oz.	$\frac{1}{2}$	$1\frac{1}{4}$	147	
Water - - - -	pint	$\frac{1}{4}$			
			8) 10		

TABLE No. 177.

Milk porridge and bacon.

General Character : MILK PORRIDGE AND BACON.—COST, $1\frac{1}{4}d.$

ACTUAL NUTRITIVE VALUE { Carbon . 1,564 grains. Nitrogen . 69 grains.

REQUIRED QUANTITY { Carbon . 1,500 grains. Nitrogen . 70 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost per 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Skimmed milk - - -	pint	$\frac{1}{2}$	2	219	$21\frac{1}{2}$
Oatmeal - - - -	oz.	$1\frac{1}{2}$	$1\frac{1}{4}$	259	13
Water - - - -	pint	$\frac{1}{2}$			
Bread - - - -	oz.	4	3	492	23
Bacon - - -	oz.	2	4	594	12
			8) $10\frac{1}{4}$		

BREAKFAST—*continued.*

TABLE No. 178.

Oatmeal brose.

General Character: OATMEAL BROSE.*—COST, 1*d.*

ACTUAL NUTRITIVE VALUE: Carbon . 1,397 grains. Nitrogen . 74 grains.

REQUIRED QUANTITY: Carbon . 1,500 grains. Nitrogen . 70 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Oatmeal - - - -	oz.	6	5¼	1,038	52½
Treacle - - - -	oz.	1	1	140	
Skimmed milk - - -	pint	½	2	219	21½
Water - - - -	pint	¼			
			8) 8¼		

TABLE No. 179.

Oatmeal brose, milk, bread, and bacon.

General Character: OATMEAL BROSE, MILK, BREAD, AND BACON.—COST, 1½*d.*

ACTUAL NUTRITIVE VALUE: Carbon . 1,990 grains. Nitrogen . 88 grains.

REQUIRED QUANTITY: Carbon . 1,500 grains. Nitrogen . 70 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Oatmeal - - - -	oz.	5	4½	865	44
Treacle - - - -	oz.	1	1	140	
Skimmed milk - - -	pint	½	2	219	21½
Water - - - -	pint	¼			
Bread - - - -	oz.	3	2¼	369	17
Bacon - - - -	oz.	1	2	297	6
			8) 11¾		

TABLE No. 180.

Rice milk and bread.

General Character: RICE MILK AND BREAD.—COST, 1¼*d.*

ACTUAL NUTRITIVE VALUE: Carbon . 1,551 grains. Nitrogen . 75 grains.

REQUIRED QUANTITY: Carbon . 1,500 grains. Nitrogen . 70 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Rice - - - - -	oz.	2	1½	336	9
Milk, skimmed - - -	pint	1	4	438	43
Treacle - - - -	oz.	1	1	140	
Spice - - - -					
Bread - - - -	oz.	4	2¼	490	23
Fat - - - - -	oz.	½	1¼	147	
			8) 10		

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* The Scotch in making porridge sprinkle half a pound of *Scotch* oatmeal into a pan with three quarts of boiling water and a teaspoonful of salt added, and stirring it constantly with a stick, let it simmer slowly from half to three-quarters of an hour.

BREAKFAST—*continued.*

TABLE No. 181.

Rice milk, bread, and bacon.

General Character: RICE MILK, BREAD, AND BACON.—COST, 1½*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 1,889 grains.
Nitrogen . 76 grains.

REQUIRED QUANTITY { Carbon . 1,500 grains.
Nitrogen . 70 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.	Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
			Carbon.	Nitrogen.
		d.	Grains.	Grains.
Rice - - - - - oz.	2	1½	336	9
Skimmed milk - - - pint	¾	3	329	32
Treacle - - - - oz.	1	1	140	
Water - - - - pint	¼			
Bread - - - - oz.	4	2¼	490	23
Bacon - - - - oz.	2	4	594	12
		8) 11¾		

TABLE No. 182.

Coffee, bread and butter.

General Character: COFFEE, BREAD AND BUTTER.—COST, 1¼*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 1,190 grains.
Nitrogen . 56 grains.

REQUIRED QUANTITY { Carbon . 1,500 grains.
Nitrogen . 70 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.	Quantity per Ration.	Cost per 8 Rations.	Per Ration.	
			Carbon.	Nitrogen.
		d.	Grains.	Grains.
Coffee and Chicory - - oz.	⅛	¼	- -	½
Skimmed milk - - - pint	½	2	219	21½
Sugar - - - - oz.	½	1	86	
Water - - - - pint	½			
Bread - - - - oz.	6	4½	738	34½
Butter - - - - oz.	½	2½	147	
		8) 10¼		

TABLE No. 183.

Coffee, bread, and bacon.

General Character: COFFEE, BREAD, AND BACON.—COST, 1⅜*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 1,528 grains.
Nitrogen . 58 grains.

REQUIRED QUANTITY { Carbon . 1,500 grains.
Nitrogen . 70 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.	Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
			Carbon.	Nitrogen.
		d.	Grains.	Grains.
Coffee - - - - oz.	⅛	¾	- -	½
Skimmed milk - - - pint	¼	1	110	11
Sugar - - - - oz.	½	1	86	
Water - - - - pint	½			
Bread - - - - oz.	6	4½	738	34½
Bacon - - - - oz.	2	4	594	12
		8) 11¼		

BREAKFAST—*continued.*

Breakfast.

TABLE No. 184.

General Character: TEA, BREAD AND BUTTER.—COST, $1\frac{1}{2}d.$

Tea, bread and butter.

ACTUAL NUTRITIVE VALUE	Carbon .	1,081 grains.	REQUIRED QUANTITY	Carbon .	1,500 grains.
	Nitrogen .	46 grains.		Nitrogen .	70 grains.
			FOR WOMEN, $\frac{1}{10}$th LESS.		

Food.		Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Tea	oz.	$\frac{1}{8}$	3	- -	1
Sugar	oz.	$\frac{1}{2}$	1	86	
Skimmed milk	pint	$\frac{1}{4}$	1	110	11
Water	pint	$\frac{1}{2}$			
Bread	oz.	6	$4\frac{1}{2}$	738	$34\frac{1}{2}$
Butter	oz.	$\frac{1}{2}$	$2\frac{1}{2}$	147	
			8) 12		

DINNER.—TO COST NOT MORE THAN 2*d.*

Dinner.

TABLE No. 185.

General Character: SUET PUDDING, BREAD AND CHEESE.—COST, $1\frac{1}{4}d.$

Suet pudding, bread and cheese.

ACTUAL NUTRITIVE VALUE	Carbon .	1,496 grains.	REQUIRED QUANTITY	Carbon .	1,800 grains.
	Nitrogen .	74 grains.		Nitrogen .	90 grains.
			FOR WOMEN, $\frac{1}{10}$th LESS.		

Food.		Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Flour	oz.	4	$3\frac{1}{2}$	664	30
Suet	oz.	$\frac{1}{2}$	$1\frac{1}{2}$	147	
Skimmed milk	pint	$\frac{1}{4}$	1	110	11
Bread	oz.	4	3	492	23
Cheese	oz.	$\frac{1}{2}$	$1\frac{1}{2}$	83	10
			8) $10\frac{1}{2}$		

TABLE No. 186.

General Character: SUET PUDDING, BREAD AND CHEESE.—COST, $1\frac{3}{4}d.$

ACTUAL NUTRITIVE VALUE	Carbon .	2,010 grains.	REQUIRED QUANTITY	Carbon .	1,800 grains.
	Nitrogen .	99 grains.		Nitrogen .	90 grains.
			FOR WOMEN, $\frac{1}{10}$th LESS.		

Food.		Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Flour	oz.	6	$5\frac{1}{4}$	996	45
Suet	oz.	$\frac{3}{4}$	$2\frac{1}{4}$	220	
Skimmed milk	pint	$\frac{1}{2}$	2	219	$21\frac{1}{2}$
Bread	oz.	4	3	492	23
Cheese	oz.	$\frac{1}{2}$	$1\frac{1}{2}$	83	10
			8) 14		

DINNER—*continued.*

Meat pudding and bread.

TABLE No. 187.

General Character: MEAT PUDDING AND BREAD.—COST, 2*d*.

ACTUAL NUTRITIVE VALUE: Carbon . 1,616 grains. Nitrogen . 71 grains.

REQUIRED QUANTITY: Carbon . 1,800 grains. Nitrogen . 90 grains.
FOR WOMEN, ⅒th LESS.

Food.	Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
			Carbon.	Nitrogen.
		d.	Grains.	Grains.
Flour - - - - oz.	4	3½	664	30
Suet* - - - - oz.	¾	2¼	220	
Meat - - - - - oz.	3	9	486	30
Bread, or - - - - oz.	2	1½	246	11½
Potatoes - - - - oz.	5			
Pepper and Salt.				
		8) 16¼		

Liver pudding and bread.

TABLE No. 188.

General Character: LIVER PUDDING AND BREAD.—COST, 2*d*.

ACTUAL NUTRITIVE VALUE: Carbon . 1,734 grains. Nitrogen . 100 grains.

REQUIRED QUANTITY: Carbon . 1,800 grains. Nitrogen . 90 grains.
FOR WOMEN, ⅒th LESS.

Food.	Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
			Carbon.	Nitrogen.
		d.	Grains.	Grains.
Flour - - - - oz.	4	3½	664	30
Suet - - - - - oz.	¾	2¼	220	
Liver - - - - oz.	4	7	307	53
Bacon - - - - oz.	1	2	297	6
Bread, or - - - - oz.	2	1½	246	11½
Potatoes - - - - oz.	5			
Seasoning.				
		8) 16¼		

Potato pie.

TABLE No. 189.

General Character: POTATO PIE.—COST, 2*d*.

ACTUAL NUTRITIVE VALUE: Carbon . 1,778 grains. Nitrogen . 71 grains.

REQUIRED QUANTITY: Carbon . 1,800 grains. Nitrogen . 90 grains.
FOR WOMEN, ⅒th LESS.

Food.	Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
			Carbon.	Nitrogen.
		d.	Grains.	Grains.
Flour - - - - oz.	3	2⅝	498	22½
Dripping - - - - oz.	¾	2¼	249	
Meat - - - - - oz.	2½	7½	405	25
Potatoes - - - - oz.	8	2⅜	380	12
Bread - - - - oz.	2	1½	246	11½
Seasoning.				
		8) 16¼		

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* The quantity of suet in Nos. 187, 188, and of dripping in 189, may be reduced to half an ounce when further economy is necessary.

DINNER—*continued.*

TABLE No. 190.

Faggots, peas pudding, bread and cheese.

General Character : FAGGOTS, PEAS PUDDING, BREAD AND CHEESE.—COST, 2*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 1,513 grains. Nitrogen . 140 grains.

REQUIRED QUANTITY { Carbon . 1,800 grains. Nitrogen . 90 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Liver - - - -	oz.	5	8¾	383	65½
Bacon - - - -	oz.	1	2	297	6
Herbs.					
Peas - - - -	oz.	3	2¼	504	47
Bread - - - -	oz.	2	1½	246	11½
Cheese - - - -	oz.	½	1½	83	10
			8) 16		

TABLE No. 191.

Meat, potatoes, bread and cheese.

General Character : MEAT, POTATOES, BREAD AND CHEESE.—COST, 2*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 1,441 grains. Nitrogen . 75 grains.

REQUIRED QUANTITY { Carbon . 1,800 grains. Nitrogen . 90 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Meat - - - -	oz.	3	9	486	30
Potatoes - - - -	oz.	8	2⅜	380	12
Bread - - - -	oz.	4	3	492	23
Cheese - - - -	oz.	½	1½	83	10
			8) 16		

TABLE No. 192.

Irish stew and bread.

General Character : IRISH STEW AND BREAD.—COST, 2*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 1,568 grains. Nitrogen . 72 grains.

REQUIRED QUANTITY { Carbon . 1,800 grains. Nitrogen . 90 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost of 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Meat - - - -	oz.	3	9	486	30
Potatoes - - - -	oz.	12	3⅝	570	18
Onions - - - -	oz.	1	½	20	1
Bread - - - -	oz.	4	3	492	23
Seasoning.					
			8) 16⅛		

DINNER—*continued.*

TABLE No. 193.

Bread and cheese.

General Character : BREAD AND CHEESE.—COST, $1\frac{1}{8}$*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 1,150 grains. Nitrogen . 66 grains.

REQUIRED QUANTITY { Carbon . 1,800 grains. Nitrogen . 90 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost per 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Bread - - - -	oz.	8	6	984	46
Cheese - - - -	oz.	1	3	166	20
			8) 9		

TABLE No. 194.

Bacon, vegetables, and cheese.

General Character : BACON, VEGETABLES, AND CHEESE.—COST, $1\frac{7}{8}$*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 1,843 grains. Nitrogen . 69 grains.

REQUIRED QUANTITY { Carbon . 1,800 grains. Nitrogen . 90 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost per 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Bacon - - - -	oz.	4	8	1,128	24
Potatoes - - - -	oz.	8	$2\frac{3}{8}$	380	12
Bread - - - -	oz.	4	3	492	23
Cheese - - - -	oz.	$\frac{1}{2}$	$1\frac{1}{2}$	83	10
			8) 15		

TABLE No. 195.

Rice pudding, bread and cheese.

General Character : RICE PUDDING, BREAD AND CHEESE.—COST, $1\frac{3}{4}$*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 1,673 grains. Nitrogen . 83 grains.

REQUIRED QUANTITY { Carbon . 1,800 grains. Nitrogen . 90 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost per 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Rice - - - - -	oz.	3	$2\frac{1}{4}$	504	13
Skimmed milk - - -	pint	1	4	438	43
Suet - - - - -	oz.	$\frac{1}{2}$	$1\frac{1}{2}$	147	
Sugar - - - -	oz.	$\frac{3}{4}$	$1\frac{1}{2}$	130	
Spice and salt - - - -	-				
Bread - - - -	oz.	3	3	369	17
Cheese - - - -	oz.	$\frac{1}{2}$	$1\frac{1}{2}$	83	10
			8) $14\frac{1}{2}$		

DINNER—*continued.*

TABLE NO. 196.

Hasty pudding, herring, and potatoes.

General Character: HASTY PUDDING, HERRING, AND POTATOES.—COST, 2*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 2,144 grains.
Nitrogen . 119 grains.

REQUIRED QUANTITY { Carbon . 1,800 grains.
Nitrogen . 90 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost per 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Flour - - - -	oz.	6	5¼	996	45
Skimmed milk - - -	pint	½	2	219	21
Water.					
Treacle - - - -	oz.	2	2	280	
Herring - - - - -		1	4	269	41
Potatoes - - - -	oz.	8	2⅝	380	12
			8) 15⅞		

TABLE NO. 197.

Fish.

General Character: FISH.—COST, 1¾*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 1,387 grains.
Nitrogen . 101 grains.

REQUIRED QUANTITY { Carbon . 1,800 grains.
Nitrogen . 90 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost per 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Herrings, fresh (two) -	oz.	9	8	472	72
Dripping - - - -	oz.	½	1½	166	
Potatoes - - - -	oz.	8	2⅝	380	12
Bread - - - -	oz.	3	2¼	369	17
			8) 14⅜		

TEA.—TO COST 1*d.*

Tea.

TABLE NO. 198.

Tea, bread and butter.

General Character: TEA, BREAD AND BUTTER.—COST, 1*d.*

ACTUAL NUTRITIVE VALUE { Carbon . 670 grains.
Nitrogen . 29 grains.

REQUIRED QUANTITY { Carbon . 1,000 grains.
Nitrogen . 40 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost per 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Tea - - - - - -	oz.	$\frac{1}{9}$	2½	- -	1
Sugar - - - - -	oz.	½	1	86	
Skimmed milk - - -	pint	⅛	½	54	5½
Water - - - -	pint	⅝			
Bread - - - -	oz.	4	3	492	23
Butter - - - -	oz.	¼	1¼	74	
			8) 8¼		

APPENDIX.

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Tea.

TEA—*continued.*

TABLE NO. 199.

Coffee, bread and butter.

General Character : COFFEE, BREAD AND BUTTER.—COST, 1*d.*

ACTUAL NUTRITIVE VALUE: Carbon . 925 grains. Nitrogen . 42 grains.

REQUIRED QUANTITY: Carbon . 1,000 grains. Nitrogen . 40 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost per 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Coffee and chicory	oz.	$\frac{1}{8}$	$\frac{3}{4}$	- -	$\frac{1}{2}$
Sugar	oz.	$\frac{1}{2}$	1	86	
Skimmed milk	pint	$\frac{1}{4}$	1	109	11
Water	oz.	$\frac{5}{8}$			
Bread	oz.	$5\frac{1}{3}$	4	656	31
Butter	oz.	$\frac{1}{4}$	$1\frac{1}{4}$	74	
			8) 8		

TABLE NO. 200.

Oatmeal pudding and treacle.

General Character : OATMEAL PUDDING AND TREACLE.
AS NO. 178.

TABLE NO. 201.

Milk porridge.

General Character : MILK PORRIDGE.—COST, 1*d.*

ACTUAL NUTRITIVE VALUE: Carbon . 1,034 grains. Nitrogen . 61 grains.

REQUIRED QUANTITY: Carbon . 1,000 grains. Nitrogen . 40 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost per 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Skimmed milk	pint	$\frac{3}{4}$	3	329	32
Oatmeal	oz.	2	$1\frac{3}{4}$	346	$17\frac{1}{2}$
Bread	oz.	2	$2\frac{1}{4}$	246	$11\frac{1}{2}$
Fat	oz.	$\frac{3}{8}$	1	103	
			8) 8		

TABLE NO. 202.

Bacon and bread.

General Character : BACON AND BREAD.—COST, 1*d.*

ACTUAL NUTRITIVE VALUE: Carbon . 1,250 grains. Nitrogen . 43 grains.

REQUIRED QUANTITY: Carbon . 1,000 grains. Nutrigen . 40 grains.
FOR WOMEN, $\frac{1}{10}$th LESS.

Food.		Quantity per Ration.	Cost per 8 Rations.	Per Ration.	
				Carbon.	Nitrogen.
			d.	Grains.	Grains.
Bacon	oz.	2	4	594	12
Bread	oz.	$5\frac{1}{3}$	4	656	31
			8) 8		

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SOUPS TO BE PROVIDED AT PUBLIC KITCHENS.—WHOLESALE PRICES.

TABLE No. 203.

OX-HEAD SOUP.

To make 125 pints, or 100 rations.

COST PER RATION . . . . 0·92*d.*
DITTO, with 6 ozs. of bread . . 1½*d.*
NUTRITIVE VALUE PER RATION (Soup only.) - { Carbon . . . 1,117 grains.
Nitrogen . . 49 grains.

FOOD.	Quantity.	Cost.	Total Cost.	Per Ration.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*	oz.	Grains.	Grains.
Meat off ox heads - lb.	13	0 4¼	4 10½	2	324	20
Bones of ditto - lb.	15	Nil.	- -	2⅕	130	4
Pearl barley - - lb.	13	0 1½	1 7½	2	332	11
Rice - - - lb.	6½	0 1	0 6½	1	168	5
Oatmeal - - lb.	6½	0 1½	0 9¾	1	173	9
Pepper - - - oz.	1½	0 1	0 1½			
Salt - - - oz.	12					
Mint, marjoram, and thyme alternately -	- -	- -	0 3			
Water to make - pints	125					
			8 2¾			
Less value of bones -	- -	- -	0 6			
TOTAL - - -	- -	- -	7 8¾			

TABLE No. 204.

PEA-SOUP.

To make 125 pints, or 100 rations.

COST PER RATION . . . . 1·28*d.*
DITTO, with 5⅓ ozs. of bread . . . 1¾*d.*
NUTRITIVE VALUE PER RATION (Soup only.) - { Carbon . . . 1,201 grains.
Nitrogen . . 58 grains.

FOOD.	Quantity.	Cost.	Total Cost.	Per Ration.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*	oz.	Grains.	Grains.
Necks of beef, without bone - - - lb.	9¾	0 5	4 0¾	1½	243	15
Pig's head, fresh, large, well-fed, without bone - - lb.	6½	0 4½	2 5¼	1	266	5
Bones of beef - - lb.	6½	0 1½	0 9	1	49	1
Barley - - - lb.	13	0 1½	1 7½	2	332	11
Peas, split - - lb.	6½	0 1¼	0 8	1	168	16
,, meal - - lb.	3¼	0 1½	0 5	½	84	8
Onions - - - lb.	6½	0 0½	0 3¼	1	20	1
Carrots - - - lb.	6½	0 0⅓	0 2¼	1	24	1
Turnips - - - lb.	6½	0 0¼	0 2	1	15	
Pepper - - - oz.	1¾	0 1	0 1¾			
Salt - - - oz.	14					
Liver - - - oz.	½	- -	0 2			
Water to make - pints	125					
			10 10¾			
Less value of bones -	- -	- -	0 3			
TOTAL - - -	- -	- -	10 7¾			

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TABLE No. 205.

PEA-SOUP.

To make 125 pints, or 100 rations.

COST PER RATION . . . . 1·16*d.*
DITTO, with 6 ozs. of bread . . . 1¾*d.*
NUTRITIVE VALUE PER RATION (Soup only.) - { Carbon . . . 1,099 grains.
Nitrogen . . . 61 grains.

FOOD.	Quantity.	Cost.	Total Cost.	Per Ration.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*	oz.	Grains.	Grains.
Meat of legs of beef, lb.	13	0 5	5 5	2	324	20
Bones of ditto - lb.	13	Nil.	- -	2	200	7
Bones - - - lb.	14	0 1½	1 9	2		
Barley - - - lb.	6½	0 1½	0 9¾	1	166	6
Peas, split - - lb.	6½	0 1¼	0 8	1	168	16
Onions - - - lb.	6½	0 0½	0 3¼	1	20	1
Carrots, crushed - lb.	13	0 0⅓	0 4¼	2	48	2
Oatmeal - - lb.	6½	0 1½	0 9¾	1	173	9
Burnt raw sugar - lb.	½	0 4	0 2			
Pepper - - - oz.	1¾	0 1	0 1¾			
Salt - - - oz.	14					
Thyme, mint, marjoram	- -	- -	0 4			
Water to make - pints	125					
			10 8¾			
Less value of bones -	- -	- -	1 0			
TOTAL - -	- -	- -	9 8¾			

TABLE No. 206.

MILK-SOUP.

To make 100 pints, or 100 rations.

COST PER RATION . . . . 1*d.*
DITTO, with 5⅓ ozs. of bread . . . . 1½*d.*

		With Pig's Head.	With Sheep's Head.
NUTRITIVE VALUE PER RATION (Soup only.)	Carbon . .	1,050 grains.	841 grains.
	Nitrogen .	36 grains.	46 grains.

FOOD.	Quantity.	Price.	Total Cost.	Per Ration.		
				Quantity.	Carbon.	Nitrogen.
		s. d.	*s. d.*	oz.	Grains.	Grains.
Pig's head, without bone - - - lb.	13	0 4½	4 10½	2	533	10
Or sheep's head, without bone - - lb.					(324)	(20)
Barley - - - lb.	6½	0 1½	0 9¾	1	166	6
Rice - - - lb.	6½	0 1	0 6½	1	168	5
Flour - - - lb.	1	0 1¾	0 1¾	⅙	27	1
Onions - - - lb.	3¼	0 0½	0 1¾	½	10	
Cloves and allspice, oz.	½	- -	0 4			
Pepper - - - oz.	1					
Salt - - - oz.	12					
Skimmed milk - pints	33¼	0 0½	1 5	⅓	146	14
Water to make - pints	100					
TOTAL - -	- -	- -	8 3¼			

Appendix.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Weekly Dietaries.

1s. 11¾d.
2s. 0d.
2s. 0½d.

WEEKLY DIETARIES.

Table No. 207.

General Character.

Cost . . . . 1s. 11¾d.

Required Quantity { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

For Women, $\frac{1}{10}$th less.

Nutritive Value - { Carbon . 28,031 grains. Nitrogen . 1,409 grains.

Food.	Quantity.	Cost.	Quantities per Week.	
			Carbon.	Nitrogen.
		s. d.	Grains.	Grains.
Bread - - - lb.	9	1 1½	17,712	828
Flour.				
Oatmeal - - - lb.	1	0 1¾	2,768	140
Peas, split.				
Rice.				
Sugar.				
Treacle.				
Butter.				
Dripping.				
Suet.				
Meat, without bone lb.	½	0 3	1,290	80
Herrings.				
Milk, skimmed - pints	3½	0 1¾	1,533	150
Butter milk - - "	3	0 0¾	1,260	129
Cheese.				
Tea.				
Coffee and chicory.				
Bacon.		0 1	1,188	12
Eggs.				
Fresh vegetables -	- -	0 2	2,280	70

Table No. 208.

General Character:

Cost . . . . 2s.

Required Quantity { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

For Women, $\frac{1}{10}$th less.

Nutritive Value - { Carbon . 28,853 grains. Nitrogen . 1,452 grains.

Food.	Quantity.	Cost.	Quantities per Week.	
			Carbon.	Nitrogen.
		s. d.	Grains.	Grains.
Bread - - - lb.	8	1 0	15,744	736
Flour.				
Oatmeal - - - lb.	1¼	0 2	3,460	175
Peas.				
Rice.				
Sugar.				
Treacle - - - lb.	½	0 1	1,120	
Butter.				
Dripping.				
Suet.				
Meat, without bone.				
Herrings - - -	3	0 1½	807	123
Milk, skimmed pints	7	0 3½	3,066	300
Butter milk.				
Cheese.				
Tea.				
Coffee and chicory.				
Bacon - - - lb.	½	0 2	2,376	48
Eggs.				
Fresh vegetables - -	- -	0 2	2,280	70

Table No. 209.

General Character:

Cost . . . . . 2s. 0½d.

Required Quantity { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

For Women, $\frac{1}{10}$th less.

Nutritive Value - { Carbon . 29,748 grains. Nitrogen . 1,291 grains.

Food.	Quantity.	Cost.	Quantities per Week.	
			Carbon.	Nitrogen.
		s. d.	Grains.	Grains.
Bread - - - lb.	8	1 0	15,744	736
Flour.				
Oatmeal - - - lb.	2	0 3½	5,536	280
Peas.				
Rice.				
Sugar - - - lb.	¼	0 1	692	
Treacle - - - lb.	1	0 2	2,240	
Butter.				
Dripping.				
Suet.				
Meat, without bone lb.	½	0 3	1,290	80
Herrings.				
Milk, skimmed - pints	7	0 3½	3,066	150
Butter milk.				
Cheese.				
Tea.				
Coffee and chicory - oz.	2	0 1½	- -	10
Bacon.				
Eggs.				
Fresh vegetables - -	- -	0 1	1,140	35

WEEKLY DIETARIES—*continued.*

TABLE No. 210.

General Character :

COST . . . . . 2s. 1d.

REQUIRED QUANTITY { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . 25,908 grains. Nitrogen . 1,154 grains.

FOOD.		Quantity.	Cost.		Quantities per Week.	
					Carbon.	Nitrogen.
			s.	d.	Grains.	Grains.
Bread - - - -	lb.	8	1	0	15,744	736
Flour - - - -	lb.	½	0	1	1,328	60
Oatmeal.						
Peas.						
Rice.						
Sugar - - - -	lb.	¼	0	1	692	
Treacle.						
Butter.						
Dripping - - -	oz.	2	0	0¾	665	
Suet.						
Meat, without bone	lb.	½	0	3	1,290	80
Herrings.						
Milk, skimmed -	pint	3½	0	1¾	1,533	150
Butter milk.						
Cheese.						
Tea.						
Coffee and chicory -	oz.	2	0	1½	- -	10
Bacon - - - -	lb.	½	0	2	2,376	48
Eggs.						
Fresh vegetables -	-	- -	0	2	2,280	70

TABLE No. 211.

General Character :

COST . . . . . 2s. 2d.

REQUIRED QUANTITY { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . 27,561 grains. Nitrogen . 1,456 grains.

FOOD.		Quantity.	Cost.		Quantities per Week.	
					Carbon.	Nitrogen.
			s.	d.	Grains.	Grains.
Bread - - -	lb.	8	1	0	15,744	736
Flour - - -	lb.	1	0	1¾	2,656	120
Oatmeal - - -	lb.	1	0	1¾	2,768	140
Peas.						
Rice.						
Sugar - - -	lb.	¼	0	1	692	
Treacle.						
Butter.						
Dripping - -	oz.	2	0	0¾	665	
Suet - - -	oz.	2	0	0¾	588	
Meat, without bone.						
Herrings - -	No.	3	0	1½	807	125
Milk, skimmed -	pint	3½	0	1¾	1,533	150
Butter milk.						
Cheese - - -	lb.	¼	0	1¼	664	79
Tea.						
Coffee and chicory -	oz.	2	0	1½	- -	10
Bacon.						
Eggs.						
Fresh vegetables -	-	- -	0	1	1,140	35
Liver - - -	lb.	¼	0	1	304	63

TABLE No. 212.

General Character :

COST . . . . . 2s. 3½d.

REQUIRED QUANTITY { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . 33,552 grains. Nitrogen . 1,511 grains.

FOOD.		Quantity.	Cost.		Quantities per Week.	
					Carbon.	Nitrogen.
			s.	d.	Grains.	Grains.
Bread - - -	lb.	10	1	3	19,680	920
Flour.						
Oatmeal - - -	lb.	1	0	1¾	2,768	140
Peas.						
Rice - - -	lb.	1	0	1½	2,688	70
Sugar - - -	lb.	¼	0	1	692	
Treacle - - -	lb.	½	0	1	1,120	
Butter.						
Dripping - -	lb.	¼	0	1½	1,330	
Suet.						
Meat, without bone.						
Herrings.						
Milk, skimmed	- pint	3	0	1½	1,314	129
Butter milk -	- pint	4	0	1	1,680	172
Cheese.						
Tea.						
Coffee and chicory	oz.	2	0	1½	- -	10
Bacon.						
Eggs.						
Fresh vegetables -	-	- -	0	2	2,280	70

WEEKLY DIETARIES—*continued.*

TABLE No. 213.

General Character:

COST . . . . . 2*s.* 4*d.*

REQUIRED QUANTITY { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . 31,035 grains. Nitrogen . 1,384 grains.

FOOD.	Quantity.	Cost.	Quantities per Week.	
			Carbon.	Nitrogen.
		s. d.	Grains.	Grains.
Bread - - - lb.	10	1 3	19,680	920
Flour.				
Oatmeal - - - lb.	1	0 1¾	2,768	140
Peas.				
Rice.				
Sugar.				
Treacle - - - lb.	½	0 1	1,120	
Butter - - - lb.	¼	0 2½	1,176	
Dripping.				
Suet.				
Meat, without bone lb.	½	0 3	1,290	80
Herrings.				
Milk, skimmed - pints	3½	0 1¾		
Butter milk.				
Cheese.				
Tea.				
Coffee and chicory.				
Bacon - - - lb.	¼	0 1	1,188	24
Eggs.				
Fresh vegetables - -	- -	0 2	2,280	70

TABLE No. 214.

General Character:

COST . . . . . 2*s.* 4¼*d.*

REQUIRED QUANTITY { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . 34,935 grains. Nitrogen . 1,548 grains.

FOOD.	Quantity.	Cost.	Quantities per Week.	
			Carbon.	Nitrogen.
		s. d.	Grains.	Grains.
Bread - - - lb.	10	1 3	19,680	920
Flour.				
Oatmeal - - - lb.	2	0 3½	5,536	280
Peas.				
Rice.				
Sugar.				
Treacle - - - lb.	½	0 1	2,240	
Butter.				
Dripping.				
Suet.				
Meat, without bone lb.	½	0 3	1,290	80
Herrings.				
Milk, skimmed - pints	3½	0 1¾	1,533	150
Butter milk.				
Cheese.				
Tea.				
Coffee and chicory.				
Bacon - - - lb.	½	0 2	2,376	48
Eggs.				
Fresh vegetables - -	- -	0 2	2,280	70

TABLE No. 215.

General Character:

COST . . . . . 2*s.* 4½*d.*

REQUIRED QUANTITY { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . 31,037 grains. Nitrogen . 1,471 grains.

FOOD.	Quantity.	Cost.	Quantities per Week.	
			Carbon.	Nitrogen.
		s. d.	Grains.	Grains.
Bread - - - lb.	8	1 0	15,744	736
Flour.				
Oatmeal - - - lb.	2	0 3½	5,536	280
Peas.				
Rice.				
Sugar - - - lb.	¼	0 1	692	
Treacle - - - lb.	1	0 2	2,240	
Butter.				
Dripping.				
Suet.				
Meat, without bone.				
Herrings.				
Milk, skimmed - pints	3½	0 1¾	1,533	150
Butter milk - - pints	3	0 0¾	1,260	129
Cheese.				
Tea.				
Coffee and chicory - oz.	2	1½	- -	10
Bacon - - - lb.	1	0 4	4,753	96
Eggs.				
Fresh vegetables - -	- -	0 2	2,280	70

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Weekly Dietaries.

2*s.* 4*d.*
2*s.* 4¼*d.*
2*s.* 4½*d.*

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Weekly Dietaries.
2*s.* 5¾*d.*
2*s.* 6*d.*
2*s.* 7½*d.*

WEEKLY DIETARIES—*continued.*

TABLE NO. 216.

General Character :

COST . . . . . . 2*s.* 5¾*d.*

REQUIRED QUANTITY { Carbon . 30,100 grains.
Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . 31,383 grains.
Nitrogen . 1,309 grains.

FOOD.	Quantity.	Cost.	Quantities per Week.	
			Carbon.	Nitrogen.
		s. *d.*	Grains.	Grains.
Bread - - - lb.	8	1 0	15,744	736
Flour - - - lb.	1½	0 2¾	3,984	180
Oatmeal.				
Peas.				
Rice - - - lb.	1	0 1½	2,688	70
Sugar - - - lb.	¼	0 1	692	
Treacle.				
Butter - - - lb.	¼	0 2½	1,146	
Dripping.				
Suet - - - oz.	2	0 0¾	690	
Meat, without bone lb.	½	0 3	1,290	80
Herrings.				
Milk, skimmed pints	3½	0 1¾	1,533	150
Butter milk.				
Cheese.				
Tea.				
Coffee and chicory - oz.	2	0 1½	- -	10
Bacon - - - lb.	½	0 2	2,376	48
Eggs.				
Fresh vegetables - -	- -	0 1	1,140	35

TABLE NO. 217.

General Character :

COST . . . . . . 2*s.* 6*d.*

REQUIRED QUANTITY { Carbon . 30,100 grains.
Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . 32,998 grains.
Nitrogen . 1,859 grains.

FOOD.	Quantity.	Cost.	Quantities per Week.	
			Carbon.	Nitrogen.
		s. *d.*	Grains.	Grains.
Bread - - - lb.	8	1 0	15,744	736
Flour.				
Oatmeal - - - lb.	2	0 3½	5,536	280
Peas - - - pint	1	0 1¾	2,688	252
Rice.				
Sugar - - - lb.	¼	0 1	692	
Treacle - - - lb.	½	0 1	1,120	
Butter - - - oz.	2	0 1¼	573	
Dripping.				
Suet.				
Meat, without bone.				
Herrings - - - No.	4	0 2	1,076	164
Milk, skimmed pints	6	0 3	2,628	258
Butter milk.				
Cheese.				
Tea.				
Coffee and chicory - oz.	1	0 0¾	- -	5
Bacon - - - lb.	¼	0 1	1,188	24
Eggs.				
Fresh vegetables - -	- -	0 1	1,140	35
Liver - - - lb.	½	0 1¾	613	105

TABLE NO. 218.

General Character :

COST . . . . . . 2*s.* 7½*d.*

REQUIRED QUANTITY { Carbon . 30,100 grains.
Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . 33,248 grains.
Nitrogen . 1,609 grains.

FOOD.	Quantity.	Cost.	Quantities per Week.	
			Carbon.	Nitrogen.
		s. *d.*	Grains.	Grains.
Bread - - - lb.	10	1 3	19,680	920
Flour.				
Oatmeal - - - lb.	1	0 1¾	2,768	140
Peas, split - - pint	½	0 1	1,344	126
Rice.				
Sugar - - - lb.	¼	0 1	692	
Treacle.				
Butter.				
Dripping - - - lb.	¼	0 1½	1,330	
Suet.				
Meat, without bone lb.	½	0 3	1,290	80
Herrings.				
Milk, skimmed pints	6	0 3	2,628	258
Butter milk.				
Cheese.				
Tea - - - - oz.	½	0 1½	- -	5
Coffee and chicory - oz.	1	0 0¾	- -	5
Bacon - - - lb.	½	0 2	2,376	48
Eggs.				
Fresh vegetables - -	- -	0 1	1,140	35

WEEKLY DIETARIES—*continued.*

TABLE No. 219.

General Character:

COST . . . . . . 2*s.* 8*d.*

REQUIRED QUANTITY { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE { Carbon . 33,578 grains. Nitrogen . 1,521 grains.

FOOD.		Quantity.	Cost.		Quantities per Week.	
					Carbon.	Nitrogen.
			s.	*d.*	Grains.	Grains.
Bread - - -	lb.	8	1	0	15,744	736
Flour.						
Oatmeal - - -	lb.	3	0	5¼	8,304	320
Peas.						
Rice.						
Sugar - - -	lb.	¼	0	1	692	
Treacle - - -	lb.	¾	0	1½	1,680	
Butter - - -	lb.	¼	0	2½	1,330	
Dripping.						
Suet.						
Meat, without bone	lb.	½	0	3	1,290	80
Herrings.						
Milk, skimmed -	pints	7	0	3½	3,066	301
Butter milk.						
Cheese - - -	oz.	2	0	0¾	332	39
Tea.						
Coffee and chicory -	oz.	2	0	1½	- -	10
Bacon.						
Eggs.						
Fresh vegetables -	-	- -	0	1	1,140	35

TABLE No. 220.

General Character:

COST . . . . . . 2*s.* 8½*d.*

REQUIRED QUANTITY { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE { Carbon . 36,499 grains. Nitrogen . 1,674 grains.

FOOD.		Quantity.	Cost.		Quantities per Week.	
					Carbon.	Nitrogen.
			s.	*d.*	Grains.	Grains.
Bread - - -	lb.	10	1	3	19,680	920
Flour.						
Oatmeal - - -	lb.	1	0	1¾	2,768	140
Peas.						
Rice - - -	lb.	1	0	1½	2,688	70
Sugar - - -	lb.	¼	0	1	692	
Treacle - - -	lb.	½	0	1	2,240	
Butter.						
Dripping - -	lb.	¼	0	1½	1,455	
Suet.						
Meat, without bone	lb.	½	0	3	1,290	80
Herrings.						
Milk, skimmed -	pints	3½	0	1¾	1,533	150
Butter milk - -	pints	3	0	0¾	1,260	129
Cheese.						
Tea.						
Coffee and chicory -	oz.	2	0	1½	- -	10
Bacon.						
Eggs.						
Fresh vegetables, reckoned as potatoes -		- -	0	2	2,280	70
Liver - - -	lb.	½	0	1¾	613	105

TABLE No. 221.

General Character:

COST . . . . . . 2*s.* 9*d.*

REQUIRED QUANTITY { Carbon . 30,100 grains. Nitrogen . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE { Carbon . 36,506 grains. Nitrogen . 1,546 grains.

FOOD.		Quantity.	Cost.		Quantities per Week.	
					Carbon.	Nitrogen.
			s.	*d.*	Grains.	Grains.
Bread - - -	lb.	8	1	0	15,744	736
Flour - - -	lb.	1	0	1¾	2,656	120
Oatmeal.						
Peas.						
Rice - - -	lb.	2	0	3	5,376	140
Sugar - - -	lb.	¼	0	1	692	
Treacle - - -	lb.	½	0	1	2,240	
Butter - - -	lb.	¼	0	2½	1,176	
Dripping.						
Suet.						
Meat, without bone	lb.	½	0	3	1,290	80
Herrings.						
Milk, skimmed -	pints	2	0	1	876	86
Butter milk - -	pints	7	0	1¾	2,940	301
Cheese.						
Tea - - - -	oz.	1	0	3	- -	10
Coffee and chicory.						
Bacon - - -	lb.	½	0	2	2,376	48
Eggs.						
Fresh vegetables -	-	- -	0	1	1,140	35

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Weekly Dietaries.

2s. 10¾d.
3s. 1½d.

WEEKLY DIETARIES—*continued.*

TABLE No. 222.

General Character :

COST . . . . 2s. 10¾d.

REQUIRED QUANTITY - { Carbon . . . . . . 30,100 grains.
{ Nitrogen . . . . . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . . . . . . 36,402 grains.
{ Nitrogen . . . . . 1,638 grains.

FOOD.		Quantity.	Cost.		Quantities per Week.	
					Carbon.	Nitrogen.
			s.	d.	Grains.	Grains.
Bread	lb.	10	1	3	19,680	920
Flour	lb.	1	0	1¾	2,656	120
Oatmeal	lb.	1	0	1¾	2,768	140
Peas.						
Rice.						
Sugar	lb.	¼	0	1	692	
Treacle	lb.	¾	0	1½	1,660	
Butter	oz.	2	0	1¼	573	
Dripping.						
Suet	lb.	¼	0	1½	1,330	
Meat, without bone	lb.	¾	0	4½	1,935	120
Herrings.						
Milk, skimmed	pints	6	0	3	2,628	258
Butter milk.						
Cheese.						
Tea.						
Coffee and chicory	oz.	2	0	1½	- - -	10
Bacon.						
Eggs.						
Fresh vegetables		- - -	0	2	2,280	70

TABLE No. 223.

General Character :

COST . . . . 3s. 1½d.

REQUIRED QUANTITY - { Carbon . . . . . . 30,100 grains.
{ Nitrogen . . . . . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . . . . . . 41,519 grains.
{ Nitrogen . . . . . 1,768 grains.

FOOD.		Quantity.	Cost.		Quantities per Week.	
					Carbon.	Nitrogen.
			s.	d.	Grains.	Grains.
Bread	lb.	12	1	6	23,676	1,104
Flour	lb.	1	0	1¾	2,656	120
Oatmeal.						
Peas.						
Rice	lb.	½	0	0¾	1,344	35
Sugar	lb.	½	0	2	1,384	
Treacle	lb.	½	0	1	1,120	
Butter.						
Dripping	lb.	¼	0	1½	1,330	
Suet	lb.	¼	0	1½	1,330	
Meat, without bone	lb.	½	0	3	1,290	80
Herrings.						
Milk, skimmed	pints	3½	0	1¾	1,533	150
Butter milk	pints	3	0	0¾	1,260	129
Cheese.						
Tea	oz.	½	0	1½	- - -	5
Coffee and chicory	oz.	1	0	0¾	- - -	5
Bacon	lb.	½	0	2	2,376	48
Eggs.						
Fresh vegetables		- - -	0	2	2,280	70

APPENDIX.

V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Weekly Dietaries.

3*s.* 3½*d.*
4*s.* 0*d.*

WEEKLY DIETARIES—*continued.*

TABLE NO. 224.

General Character:

COST . . . . 3*s.* 3½*d.*

REQUIRED QUANTITY - { Carbon . . . . . . 30,100 grains.
{ Nitrogen . . . . . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . . . . . . 36,391 grains.
{ Nitrogen . . . . . 1,620 grains.

FOOD.		Quantity.	Cost.	Quantities per Week.	
				Carbon.	Nitrogen.
			s. d.	Grains.	Grains.
Bread - - - -	lb.	10	1 3	19,680	920
Flour - - - -	lb.	½	0 1¾	1,328	60
Oatmeal - - - -	lb.	½		1,384	70
Peas.					
Rice - - - -	lb.	½	0 0¾	1,344	35
Sugar - - - -	lb.	½	0 2	1,384	
Treacle - - - -	lb.	½	0 1	1,120	
Butter - - - -	lb.	¼	0 2½	1,146	
Dripping.					
Suet - - - -	oz.	2	0 0¾	665	
Meat - - - -	lb.	1½	0 9	3,870	240
Herrings.					
Milk, skimmed - -	pints	5	0 2½	2,190	215
Butter milk.					
Cheese.					
Tea - - - -	oz.	½	0 1½	- - -	5
Coffee and chicory - -	oz.	1	0 0¾	- - -	5
Bacon.					
Eggs.					
Fresh vegetables - - -		- - -	0 2	2,280	70

Suited to persons needing a full dietary.

TABLE NO. 225.

General Character:

COST . . . . . . 4*s.*

REQUIRED QUANTITY - { Carbon . . . . . . 30,100 grains.
{ Nitrogen . . . . . 1,400 grains.

FOR WOMEN, $\frac{1}{10}$th LESS.

NUTRITIVE VALUE - { Carbon . . . . . . 31,139 grains.
{ Nitrogen . . . . . 1,413 grains.

FOOD.		Quantity.	Cost.	Quantities per Week.	
				Carbon.	Nitrogen.
			s. d.	Grains.	Grains.
Bread - - - -	lb.	8	1 0	15,744	736
Flour - - - -	lb.	1	0 1¾	2,656	120
Oatmeal.					
Peas.					
Rice - - - -	lb.	½	0 0¾	1,344	35
Sugar (loaf) - - -	lb.	½	0 3	692	
Treacle.					
Butter (fresh) - - -	lb.	½	0 7	2,352	
Dripping.					
Suet - - - -	oz.	2	0 0¾	690	
Meat - - - -	lb.	1½	0 9	3,870	240
Herrings.					
Milk (new) - - -	pint	3½	0 3½	1,911	151
Butter milk.					
Cheese (good) - - -	oz.	2	0 1	332	39
Tea - - - -	oz.	1	0 3	- - -	10
Coffee and chicory - -	oz.	1	0 0¾	- - -	5
Bacon (good) - - -	lb.	¼	0 1½	1,188	24
Eggs - - - -	-	3	0 2	360	53
Fresh vegetables - - -		- - -	0 2		

Suited to the aged and to some who are not in good health. The articles are quoted at higher prices.

Appendix.

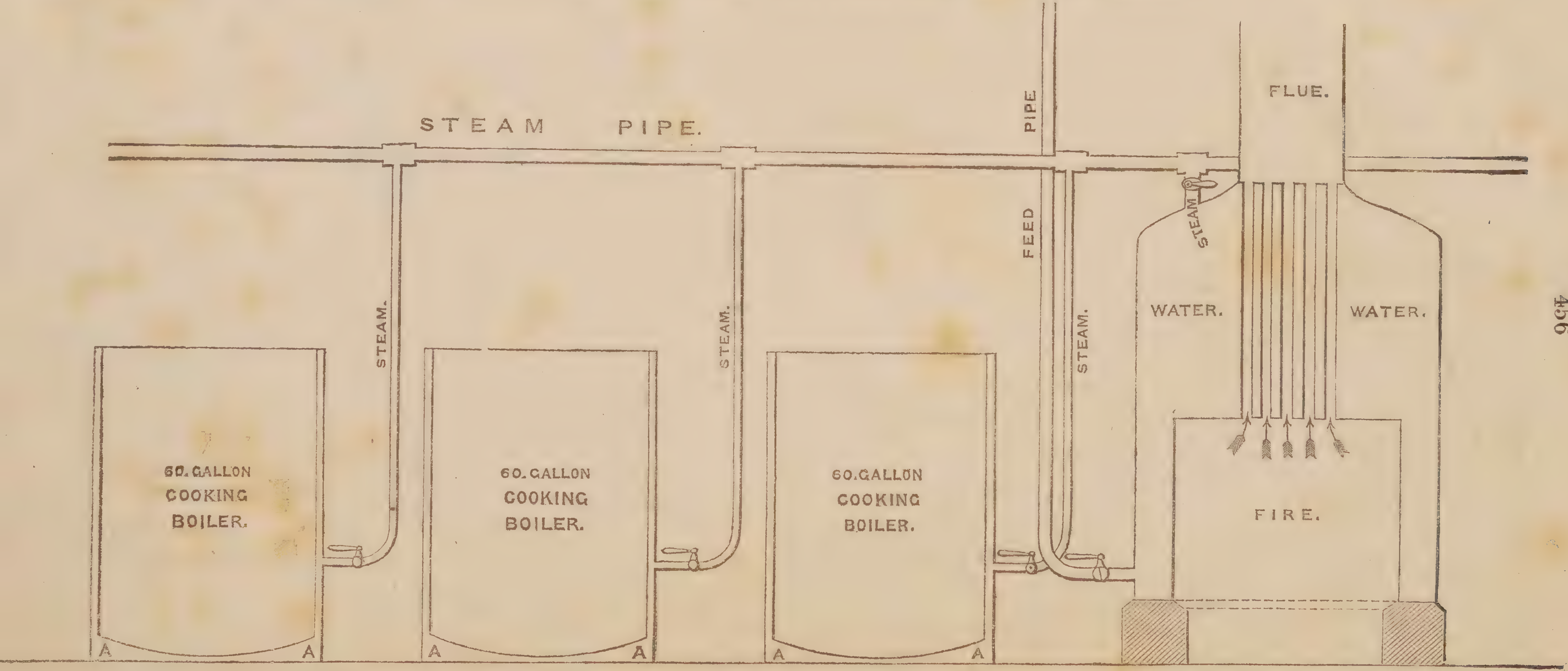
V. The Cotton Famine.

3. Economics of diet.

Supplement to Dr. E. Smith's Report.

Note.

The most convenient apparatus for cooking soup is that of boilers heated by steam, either with the steam carried into the soup or into a chamber surrounding the boiler. The latter is the more expensive, but doubtless the best arrangement, and it is represented in the following diagram of the apparatus in use at the Gaythorn Cooking Depôt, kindly furnished by Mr. Machaffie.



A. Chamber for Steam.

Boiler for supplying Steam.